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TREATMENT OF ATROPHY OF THE OPTIC NERVE

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Study of vascular tension in the retina has made it possible to explain the formation of papilledema [1] and to measure the intracranial pressure without resorting to lumbar puncture, by measuring the diastolic venous pressure in the retina. More than two years ago my associates and I began to study the vascular tension in all conditions of the optic nerve and of the retina.

Sobański [2] and I [3] have reported some of the results of our work, the credit for which goes to Sobański. As our experience has increased and the number of cases in which treatment has been given has enlarged, many of the patients having been studied for a considerable length of time, it seems justifiable to submit the results of these investigations for the criticism of our colleagues.

In examining the vascular tension in the retina of tabetic patients affected with atrophy of the optic nerve the striking fact was that the arterial pressure, especially the diastolic pressure, was low. The normal level of the systolic arterial pressure in the retina lies between 70 and 88 mm. of mercury, the level of the diastolic pressure, between 40 and 56 mm. of mercury. Therefore the lowest level of the vascular tension in the retina lies 14 mm. above the highest level of the normal intra-ocular tension (26 mm.). This is the necessary condition for normal circulation in the capillaries of the retina. If the relation between the intra-ocular tension and the arterial pressure is diminished, there is resulting disturbance of the capillary circulation, the normal

1. Lauber, H.: The Formation of Papilledema, Arch. Ophth. **13**:733 (May) 1935.

2. Sobański, J.: Istota tabetycznych zaników nerwów wzrokowych i ich leczenie, Klin. Oczna **13**:239, 1935.

3. Lauber, H.: Der Einfluss niedrigen allgemeinen Blutdruckes auf den Verlauf von Sehnervenerkrankungen, Wien. klin. Wchnschr. **48**:1079, 1935; Das Verhältnis des allgemeinen Blutdruckes und des Druckes in den Netzhautgefässen zum intraokulären Druck und sein Einfluss auf den Sehnerven und die Netzhaut, Ztschr. f. Augenh. **87**:65, 1935; L'hypotonie vasculaire générale, son rapport à la pression oculaire et aux maladies du nerf optique, Bull. et mém. Soc. franç. d'opht. **48**:429, 1935.

level of which lies between 33 mm. (diastolic pressure) and 55 mm. (systolic pressure), according to Sobański's investigations. The rise in the intra-ocular tension in patients with glaucoma reduces the difference between the intra-ocular tension and the capillary blood pressure. In many cases the capillaries are compressed by the intra-ocular tension, which frequently rises above the level of the diastolic pressure, occasionally even exceeding the systolic arterial pressure. The consequence is a slowing down of the capillary circulation or its total obstruction. The retinal tissues, which are sensitive to lack of oxygen, as are all tissues of the central nervous system, show a marked diminution in function, the expression of which is diminished central vision and constriction of the field of vision. As the arterial pressure is lower in the smaller vessels, the nutrition of the peripheral parts of the retina suffer before the central parts show marked signs of deficiency. This is perfectly in accordance with the phenomena observed on external compression of the eye. If the intra-ocular tension is raised by pressure on the surface of the globe, a mist is formed, and there is progressive concentric contraction of the field of vision, terminating in total loss of vision. These considerations are corroborated by clinical observations of high intra-ocular tension without signs of glaucoma. We have found in such cases that the general and the retinal blood pressure was considerably higher than normal. Consequently, the difference between the intra-ocular tension and the retinal blood pressure was normal, and the nutrition of the retinal tissues was adequate. Reports of cases published by Gallois [4] prove that in glaucoma a diminution of the blood pressure has a fatal influence on the progress of the disease. Here the proportion between the two important factors is disturbed, with an increase in the progress of the glaucomatous changes. There is no doubt that in many cases of glaucoma the blood pressure is higher than normal but insufficient to preserve the normal difference between the intra-ocular tension and the retinal blood pressure.

A study of patients with tabes has proved that many do not show any disturbances of the relation between the intra-ocular tension and the retinal blood pressure. Examination of a considerable number of tabetic patients without symptoms of ocular involvement proved that they had a normal or an increased blood pressure, both general and retinal (chart 1, *1* to *6*). A few patients had a low diastolic arterial pressure in the retina but at the same time a low intra-ocular tension (chart 1, *7* to *9*). Those patients, however, who had signs of involvement of the optic nerve showed disturbances of the blood pressure.

4. Gallois, J.: Glaucome chronique et abaissement de la tension artérielle générale, Bull. Soc. d'opht. de Paris, February 1933, p. 110.

Strisower [5] has published interesting observations on the behavior of the blood pressure in patients suffering from tabes. Many of them show great lability of the blood pressure. Physical exertion frequently causes a pronounced fall in the pressure, which is not observed in normal persons. My associates and I have frequently seen the blood pressure in a tabetic patient drop markedly when he remained in a recumbent position for a long time—a phenomenon that is not so pronounced in a normal person.

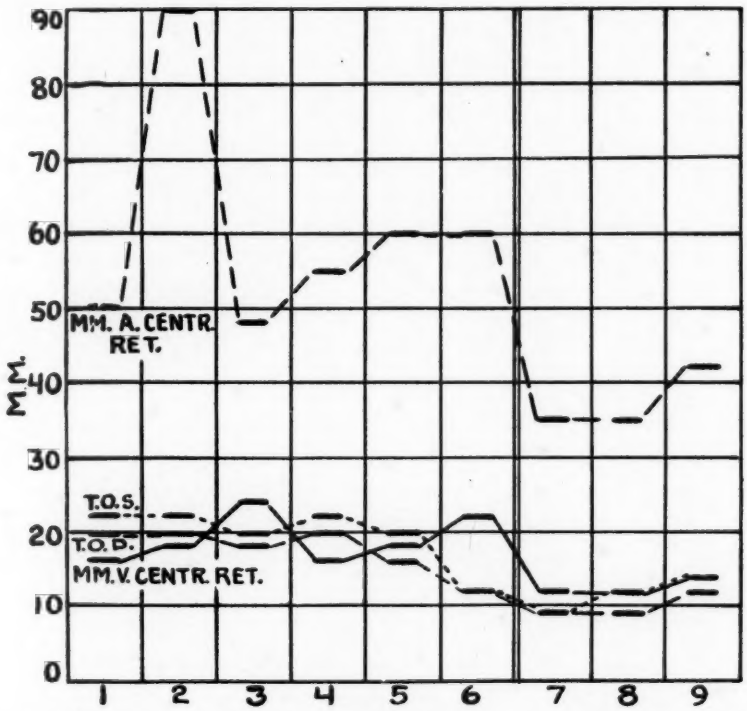

Chart 1.—Data for patients with tabes, but with no disturbance of the relation between the intra-ocular tension and the retinal blood pressure—*1* to *6* is a group without symptoms of ocular involvement and with a normal or increased general and retinal blood pressure; *7* to *9* is a group with a low diastolic arterial retinal pressure and a low intra-ocular tension. *Mm. A. centr. ret.* indicates the diastolic blood pressure in the retina; *T. O. S.*, the intra-ocular tension of the left eye; *T. O. D.*, the intra-ocular tension of the right eye; *Mm. V. centr. ret.*, the diastolic venous blood pressure in the retina.

Purely hydrodynamic considerations led us to consider the diminution of the blood pressure in the tabetic patient suffering from atrophy of the optic nerve as one of the chief factors causing the disorder, by

5. Strisower, R.: Ueber bedeutende Blutdrucksenkung nach Arbeit und bei Aenderung der Körperlage bei Tabes dorsalis, Ztschr. f. klin. Med. **117**:384, 1931; Weitere Beiträge zur Blutdruckregulationsstörung der Tabiker, Wien. med. Wchnschr. **83**:122, 1933.

malnutrition of the retina. One cannot deny that syphilitic infection may play a great part in the atrophy of the nerve. If, however, one bears in mind that at the period of greatest propagation of the spirochetes in the organism, i. e., during the period of secondary syphilis, atrophy of the optic nerve is not observed (though optic neuritis is frequently seen), that in syphilitic meningitis atrophy of the optic nerve is seen as a consequence of compression of the nerve by shrinking exudation but not as an immediate consequence of the syphilitic inflammation, one will have to be cautious in attributing to the virus of syphilis too great an immediate part in the production of atrophy of the optic nerve. One must remember that research to determine the presence of the spirochetes in the tissues of the brain and of the optic nerve in cases of atrophy of the latter has proved unsuccessful. It is also improbable that the virus of syphilis possesses a different distribution in patients with and in those without atrophy of the optic nerve. To a certain degree one observes the same hydrodynamic conditions in other than tabetic forms of atrophy of the optic nerve.

The facts just stated have led my associates and me to consider different forms of lesions of the optic nerve from the point of view of hydrodynamics. The disturbance of the normal relation between the blood pressure and the ocular tension in glaucoma is evident. In persons with atrophy of the optic nerve after marked loss of blood the blood pressure is exceedingly low, as Balard [6] and Moulinier [7] have stated, falling to 50 mm. of mercury. We have seen similar conditions in patients with atrophy of the optic nerve caused by multiple sclerosis and in Leber's hereditary atrophy of the optic nerve. In persons with retinitis pigmentosa also the retinal blood pressure is low, frequently very low. One can easily coordinate these facts and deduce from them that in all the aforementioned disorders the hydrodynamic conditions are indentical in principle.

The certitude that disturbance of the normal hydrodynamics is one of the main factors in producing atrophy of the optic nerve pointed out the way to treat this condition. One must either raise the general blood pressure or lower the intra-ocular tension or try to apply both these principles of treatment. Our observations showed us that patients suffering from tabes frequently have a low blood pressure, which appears periodically. This applies to the spontaneous behavior of vascular pressure. This circumstance explains why atrophy of the optic nerve shows periods of progression, periods of stability of the ocular function and, exceptionally, even periods of improvement. We shall have to follow up patients with tabes for a long time to become familiar with all the peculiarities of the vascular pressure in this dis-

6. Balard, P.: Rev. franç. de gynéc. et d'obst. **15**:154, 1920.
7. Moulinier, R.: Gaz. hebd. de sc. méd. de Bordeaux, 1914.

order. Important for us were observations of the changes in the blood pressure of patients subjected to different modes of treatment.

REPORT OF CASES

CASE 1.—A man aged 70, who had contracted syphilis at the age of 20, had had antisyphilitic treatment. Thirty-four years previous to examination by my associates and me signs of tabes had been noted. He had been treated with strychnine, electricity and general roborant means. No treatment for syphilis was given. He was first examined on Dec. 27, 1933. The field of vision for a white stimulus 3 mm. in size at a distance of 330 mm. was normal; for a red stimulus 5 mm. in size at a distance of 330 mm. its upward limit was 40 degrees. The disks of both eyes were pale pink and showed physiologic cuppings. The retinal arteries were rather narrow and had thickened walls. Gunn's syndrome was present. In red-free light nerve fibers were distinctly visible. The ocular tension was 24 mm. in the right eye and 20 mm. in the left. Vision in each eye was from 6/9 to 6/6. The general blood pressure in millimeters of mercury was 210 systolic and 110 diastolic. The retinal arterial pressure in millimeters of mercury was 130 systolic and 60 diastolic. The neurologic diagnosis was tabes. The Wassermann reaction of the blood was negative.

On account of the high general blood pressure the patient was ordered to take iodides. On March 2, 1934, he stated that his general condition had improved; his eyesight, however, had diminished. Vision in the right eye was 6/9, and that in the left, from 6/9 to 6/6. The tension in the right eye was 22 mm., and that in the left, 20 mm. The general blood pressure was 165 systolic and 70 diastolic, and the retinal arterial pressure was 90 systolic and 40 diastolic. The field for a red stimulus 5 mm. in size at a distance of 330 mm. showed a constriction from above to 15 degrees; otherwise, the fields of vision were unaltered. The patient returned on Oct. 16, 1934, complaining of poor vision in the right eye. The general condition was unsatisfactory. Vision in the right eye was from 6/24 to 6/18, and that in the left, 6/9. The field of vision of the right eye showed marked contraction for a white stimulus 3 mm. in size at a distance of 330 mm. and for a red stimulus 5 mm. in size at a distance of 330 mm., in contrast to the previous condition and to the extent of the field of the left eye. The tension in the right eye was 22 mm., and that in the left, 16 mm. The general blood pressure was 160 systolic and 65 diastolic, and the retinal arterial pressure was 90 systolic and 40 diastolic. A 1 per cent solution of pilocarpine was prescribed, to be instilled into each eye once a day. On Nov. 14, 1934, vision in the right eye was 6/18; the field was more contracted, and the tension was 18 mm. Vision in the left eye was 6/9; there was slight contraction of the field, and the tension was 16 mm. The general arterial pressure was 195 systolic and 85 diastolic, and the retinal arterial pressure was 100 systolic and 45 diastolic. Pilocarpine was now instilled into the eyes three times a day, and further examinations, in December 1934, and February and April 1935, showed that the intra-ocular tension had dropped to from 14 to 16 mm. Vision remained unaltered; the field of vision was somewhat improved (chart 2).

Comment.—This case illustrates the effect of medication. The treatment was efficacious in respect to the general as well as to the retinal blood pressure, which was considered as favorable in the beginning of our medical observation. The progress of atrophy of the optic nerve, however, soon proved that the measures had been injurious to the

patient's vision and later to his general condition also. The logical consequence was to discard the iodides and to try to diminish the ocular tension by instillation of pilocarpine, and to raise the blood pressure by injections of strychnine. Chart 2 illustrates well the related facts.

Not only iodides lower the vascular tension. We have found that the application of mercury, arsphenamine and other organic combinations of arsenic and bismuth has the same results. This explains why treatment for syphilis in the presence of atrophy of the optic nerve is so frequently injurious to the optic nerve. Many oculists and

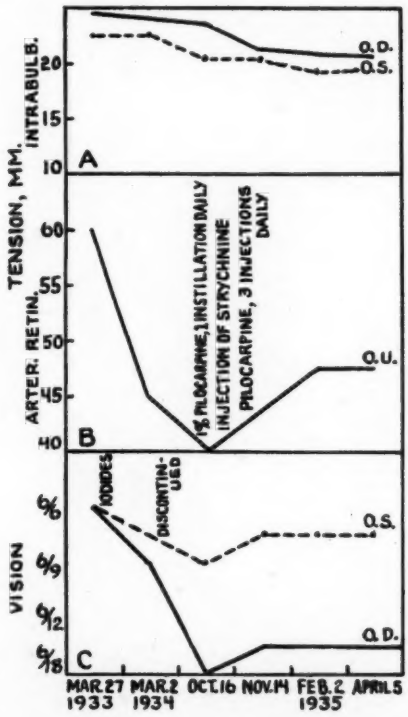

Chart 2 (case 1).—*A* shows the intra-ocular tension; *B*, the diastolic arterial pressure in the retina, and *C*, the acuity of vision of each eye.

neurologists are absolutely opposed to treatment for syphilis in the presence of atrophy of the optic nerve on account of the harm that it does in this condition. Thus a therapeutic dilemma exists: as tabes is considered a syphilitic involvement of the nervous system, treatment based on the etiologic condition, viz., treatment for syphilis, is indicated. Not to give treatment for syphilis seems to be opposed to the duty of the physician. But to give it harms the patient. The consequence of this dilemma was frequently therapeutic nihilism in cases of atrophy of the optic nerve. My associates and I have had a considerable number of patients who noted distinct deterioration of vision during dif-

ferent kinds of treatment for syphilis—treatment with mercury, iodides, arsphenamine and bismuth, and malarial therapy. With increasing experience we became convinced that it is not admissible to give patients suffering from tabes treatment for syphilis without first studying the blood pressure and its relation to the intra-ocular tension. We acted accordingly. By giving injections of strychnine and an appropriate diet (and later also hormonal treatment) we tried to raise the general blood pressure in our patients. At the same time we endeavored to lower the intra-ocular tension. A pilocarpine salt in a 2 per cent or higher solution, instilled as often as every two hours and adminis-

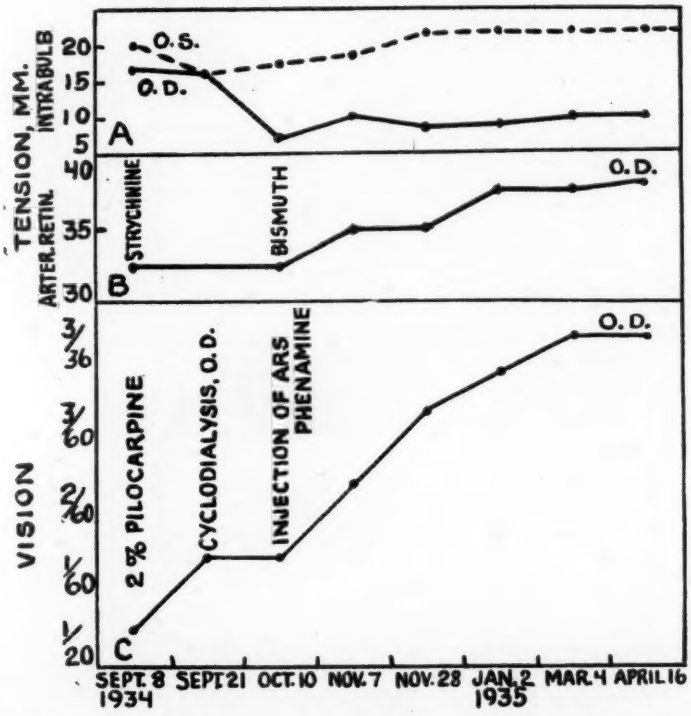

Chart 3 (case 2).—*A* shows the intra-ocular tension; *B*, the diastolic arterial pressure in the retina, and *C*, the acuity of vision of the right eye.

tered in the evening as salve, proved efficacious in a number of cases. Frequently, however, the resultant lowering of the intra-ocular tension was insufficient, and we had to resort to operation. We chose cyclodialysis because it is a simple procedure that seldom leads to complications and because it acts sufficiently on the intra-ocular tension in most cases. This operation almost always satisfied us, lowering the intra-ocular tension to 14, 12 or even 10 mm. of mercury. Iridectomy, which we performed in some cases for special reasons, proved inefficacious. This confirms the experience of many authors in respect to the results of iridectomy in cases of simple glaucoma.

The history in a characteristic case is as follows:

CASE 2.—The patient had a low blood pressure (the diastolic arterial pressure in the retina was 32 mm.) and a normal intra-ocular tension (16 mm. in the right eye and 20 mm. in the left). The left eye, which showed the higher intra-ocular tension, was blind. Vision in the right eye was 1/120. After a short period of treatment by the instillation of pilocarpine, which had little influence on the condition, cyclodialysis caused the tension to fall to 6 mm. Injections of strychnine and, after the cyclodialysis, treatment with neoarsphenamine, which acted on the syphilitic vascular disorder, raised the diastolic arterial pressure in the retina to 35 mm. Both these circumstances had a marked influence on the acuity of vision, which rose to 3/36 (chart 3).

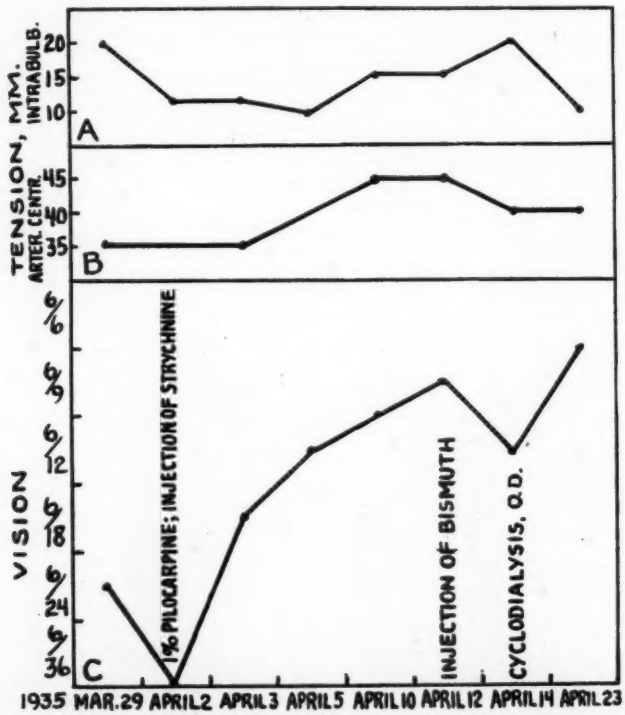

Chart 4 (case 3).—*A* shows the intra-ocular tension; *B*, the diastolic arterial pressure in the retina, and *C*, the acuity of vision of the right eye.

CASE 3.—In another patient, whose right eye had vision of 6/24 and whose left eye was blind, the diastolic arterial pressure in the retina amounted to only 35 mm., the intra-ocular tension being 16 mm. During the initial observation vision diminished rapidly. Instillations of pilocarpine combined with injections of strychnine led to an increase of the arterial pressure, which rose above 40 mm., and to a lowering of the ocular tension, which fell to 8 mm. Vision improved to 6/9. Under the action of injections of a bismuth compound the blood pressure began to fall, and vision showed a diminution simultaneously with the rise of the intra-ocular tension. Cyclodialysis caused the tension to fall to 7 mm. and thus led to further improvement of vision, to 6/6 (chart 4).

Comment.—After analyzing the cases in which the patients were followed up, thirty-three in number, it can be stated that in only a few instances was the expected result not obtained with our treatment. Chart 5 *A* shows the ocular tension before the beginning of the treatment, the diastolic blood pressure and the intra-ocular tension, as

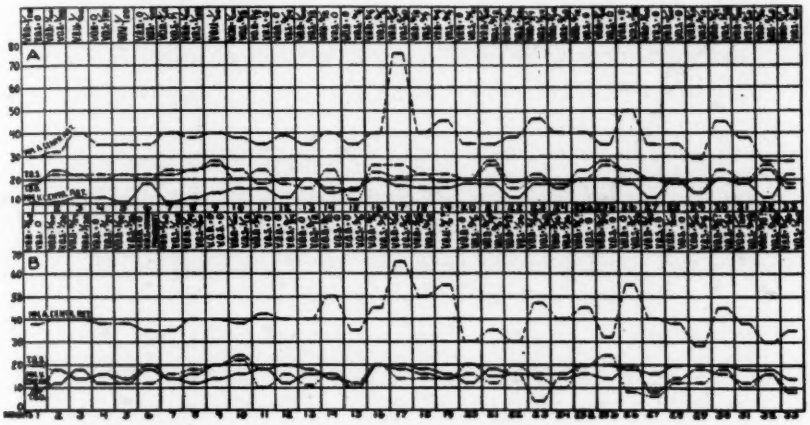

Chart 5.—Data for thirty-three patients with atrophy of the optic nerve. *A*, condition before treatment; *B*, condition after treatment. *Mm. A. centr. ret.* indicates the diastolic arterial pressure in the retina; *Mm. V. centr. ret.*, the diastolic venous pressure in the retina; *T. O. D.*, the intra-ocular tension of the right eye, and *T. O. S.*, the intra-ocular tension of the left eye.

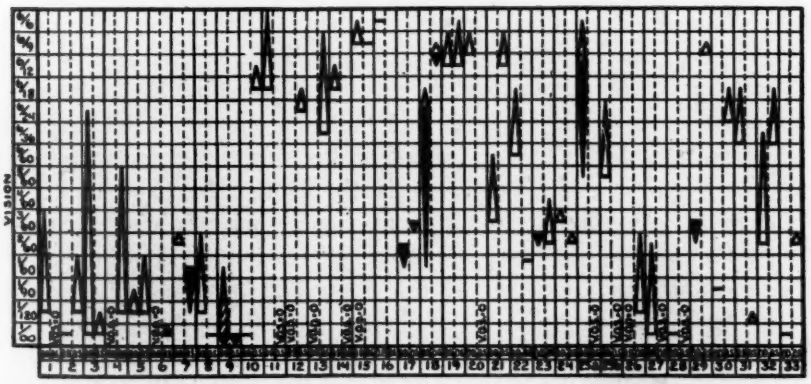

Chart 6.—Changes of acuity of vision during observation of thirty-three patients under treatment.

well as the acuity of vision at the same period. Chart 5 *B* shows the data obtained after the treatment or at the time of the last examination of the patient. The data for each eye are registered separately, as the conditions of each eye of the same person frequently present individual features. The next graph (chart 6) shows the results obtained

for central vision in the same thirty-three cases. The changes of vision are represented by triangles, the bases of which show the acuity of vision at the onset of the treatment, the tips showing the ultimate acuity of vision. If the vision improved, the tip of the triangle points upward and the triangle is white; if it diminished, the tip of the triangle points downward and the triangle is black. The shaded triangles directed with the tip upward indicate temporary improvement. By comparing the graphs one can survey the relation between the changes in respect to blood pressure and intra-ocular tension and the changes of acuity of vision.

The characteristics in the cases in which improvement followed treatment are the initial low diastolic blood pressure in the retina and the comparatively high intra-ocular tension before the treatment. In many cases the blood pressure rose, and in all the cases the intra-ocular tension fell. One can observe a parallelism between these changes and the improvement of vision. These results were obtained in spite of the fact that in the meantime treatment for syphilis had been administered. Patients whose vision previously had been more or less severely injured by treatment for syphilis underwent the same treatment without impairment of their eyesight. This is an important point. It proves that treatment for syphilis is injurious to the retina if administered during a period of low blood pressure and that by lowering it further hampers the capillary circulation in the retina. If, however, the blood pressure is kept high or the intra-ocular tension is kept low, this noxious influence of the treatment for syphilis does not appear. These facts are an important indication to all physicians administering treatment for syphilis: mercury, iodides, arsphenamine and other combinations of arsenic and bismuth and malarial therapy. All these can be given without harm to the patient as long as the vascular pressure is not low or is not lowered. It is therefore necessary to control the vascular conditions of the patient closely when giving treatment for syphilis. In many cases it is necessary in order to raise the patient's blood pressure. In a number of our cases the low level of the blood pressure led us to examine the patient's general condition accurately, and we could trace the presence of aortic dilatation of syphilitic origin. In these cases the treatment for syphilis was strictly indicated as treatment of the aortic condition. These aortic changes would have passed unnoticed but for the examination of the blood pressure. It is probable that low blood pressure is one of the chief causes of various disturbances in tabes, and it will be necessary to give special attention to this question from the point of view of internal medicine and of neurology.

The instances in which we obtained no improvement are not numerous. To this group belong cases in which the patient did not follow the prescribed treatment. Cases in which treatment improved the condition but was subsequently discontinued by the patient are instructive. The consequence was considerable loss of vision, which to a certain degree was regained on renewal of treatment.

The causes of failure in our treatment must be considered individually in each case. The most important patient of this group is a man who showed a high diastolic blood pressure in the retina. At first

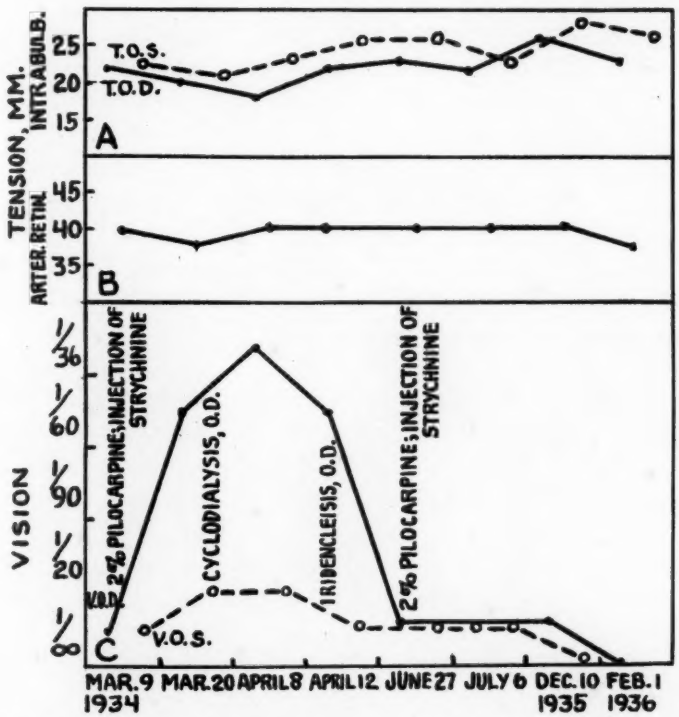

Chart 7 (case 4).—*A* shows the intra-ocular tension; *B*, the diastolic arterial pressure, and *C*, the acuity of vision.

the patient was considered to be suffering from tabes. Later the condition was proved to be progressive paralysis. In this disease the changes in the optic nerve are due not to circulatory disturbances in the retina but to the cerebral process itself.

There are also conditions in which one does not succeed in lowering the intra-ocular tension. These conditions belong to a group of simple glaucoma and in their behavior show the same characteristics. Unfortunately, one is not able to control or reduce the tension in all instances of glaucoma. Cases in which neither medicamentous nor

operative treatment is efficacious are met with from time to time by all oculists. If this kind of reaction to treatment occurs in cases of atrophy of the optic nerve the results must be negative. This is illustrated by the following case:

CASE 4.—A patient had only perception of light in both eyes at the onset of the treatment. The diastolic blood pressure was low and could not be raised by treatment. Instillations of pilocarpine and cyclodialysis performed on the right eye lowered the intra-ocular tension from 23 to 18 mm. The vision rose to 1/36. Unfortunately, the intra-ocular tension began to rise again, and simultaneously vision fell to 1/60. Iridencleisis and pilocarpine did not succeed in lowering the intra-ocular tension, which rose again to 23 mm. The disorder led to total blindness. For a few months, however, the patient showed distinct improvement of the ocular functions (chart 7).

GENERAL COMMENT

Essentially, the cases of tabetic (and some other kinds of) atrophy of the optic nerve do not differ in principle from cases of glaucoma. In both groups the normal relation between the intra-ocular tension and the blood pressure is altered, the difference between the two being diminished. In glaucoma, the intra-ocular tension is increased and rises so high as to hamper first the venous and capillary circulation in the retina and subsequently even the arterial circulation. As has been pointed out previously, the height of the general blood pressure in a person with glaucoma is by no means indifferent. The lower it is, the worse is the prognosis. Virtually one could heal glaucoma in which the intra-ocular tension was very high by raising the blood pressure to an exceedingly high level. But this cannot be done. Up to now no medication is available which will permit one to raise the blood pressure deliberately. My associates and I have sometimes found that to obtain even a slight increase of the blood pressure proves almost impossible. It must not be forgotten either that a considerable increase of the blood pressure might harm the patient's general condition very much. Among the patients with glaucoma the oculist sees some with high blood pressure. But this high level of vascular pressure generally proves insufficient to compensate the high intra-ocular tension and therefore has not been studied with due attention up to now. At any rate, in treating glaucoma the oculist will have to pay more attention to the general blood pressure and be cautious in lowering it in patients with this condition.

In atrophy of the optic nerve resulting from tabes (which is a classic example and at the same time is responsible for the condition in the largest group of cases of atrophy of the optic nerve) the relation of the vascular pressure to the ocular tension is disturbed by a diminution of the blood pressure, so that the "normal" intra-ocular tension becomes too high in relation to the blood pressure.

It is interesting that some authors have obtained favorable results in diseases of the eye by increasing the blood pressure.

The idea of improving the ocular functions in optic nerve atrophy has occurred to Deutschmann,[8] Friede[9] and Gilbert.[10] These authors endeavored to obtain improvement of vision in cases of atrophy of the optic nerve in which the condition was far advanced by punctures of the anterior chamber, sclerectomy and Elliot's trephining. Only Friede reported some improvement by repeated punctures of the anterior chamber in two cases. This coincides with an observation of Magitot, who told me that years ago he had made punctures of the anterior chamber in cases of atrophy of the optic nerve in order to obtain aqueous. The patients spontaneously declared that they saw better after the punctures. Magitot, however, did not attribute any special importance to these declarations. Between these therapeutic attempts and the procedure of my associates and me there is a great difference. We now possess an accurate foundation for our treatment, proceed systematically and consider not only the condition of intra-ocular tension but also, as a decisive factor, the blood pressure, which had not been taken into consideration by the authors just named.

Other authors have tried to attack the problem from another side. Magitot[11] has attempted to improve the retinal circulation by the operation of Leriche on the internal carotid artery. Patients 3 and 4 of his series suffering from atrophy of the optic nerve due to tabes showed remarkable improvement after the operation. The graph illustrating these cases shows a considerable rise of the blood pressure in the retina after the operation (from 35 to 70 mm. in patient 2 and from 35 to 55 mm. in patient 4). These facts agree perfectly with our observations. The cases published by Löwenstein[12] cannot be analyzed in a satisfactory way, because the blood pressure was not mentioned.

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8. Deutschmann, R.: Gibt es eine operative Beeinflussung der Sehnervenatrophie? Ztschr. f. Augenh. **53**:1, 1924.

9. Friede, R.: Gibt es eine operative Beeinflussung der Sehnervenatrophie? Ztschr. f. Augenh. **52**:99, 1924.

10. Gilbert, W.: Zur operativen Behandlungen der Opticusatrophie, Ztschr. f. Augenh. **53**:344, 1924.

11. Magitot, A.: Atrophies optiques et sympathectomie péri-carotidienne, Bull. Soc. d'opht. de Paris, July 1934, p. 358; La sympathectomie carotidienne comme thérapeutique de certaines affections dégénératives du nerf optique et de la rétine, Bull. Acad. de méd., Paris **3**:816, 1934; Bull. et mém. Soc. franç. d'opht. **47**:361, 1934; La sympathectomie carotidienne chez l'homme et ses applications dans certaines affections du nerf optique et de la rétine, Ann. d'ocul. **171**:897, 1934.

12. Löwenstein, A.: Die Sympathectomie (Leriche-Doppler) zur Behandlung der Affektionen der Netzhaut und des Sehnerven, Klin. Monatsbl. f. Augenh. **94**:705, 1935; Sympathektomie (Leriche-Doppler) an der Carotis zur Behandlung von atrophischen Prozessen in der Netzhaut und dem Sehnerven, Arch. f. Ophth. **133**:636, 1935.

Skepticism in respect to our results is perfectly justified, and therefore we shall be glad if many oculists will take the trouble of checking our findings by applying the same mode of examination and treatment to their patients. Dr. Mawas of Paris confirmed our results personally in one case. Dr. Arruga of Barcelona has corroborated our results in a letter. In the ophthalmologic department of two hospitals in Warsaw results similar to ours have been obtained.

Neurologists who see many patients with tabes will, we hope, be able to prevent the appearance of atrophy of the optic nerve by applying our method of treatment to their patients. In the way of social help attention given to the problem of low blood pressure in syphilis may give good results and diminish the number of the blind. Let it be hoped that a larger number of oculists will obtain similar results.

The problem that we have attempted to solve is an important one, as atrophy of the optic nerve is, unfortunately, frequent and contributes a considerable percentage to the number of the blind. I would lay great stress not so much on the treatment of the atrophy as on its prevention. It is a great joy for a physician if he can improve the vision of one or several patients. He will, however, have done more good to patients if by adequate measures he prevents the appearance of atrophy of the optic nerve. I am convinced that if sufficient attention is given to the general and the local blood pressure in cases of syphilis and tabes, lowering of the blood pressure will frequently be detected and suitable measures applied. It will be sufficient to avoid medication for syphilis during the periods of low blood pressure or to administer it under constant control of the blood pressure in order to reduce considerably or even to prevent the appearance of atrophy of the optic nerve. In this way one source of misfortune and misery may be suppressed by medical measures.

IRIDECTOMY WITH CYCLODIALYSIS FOR THE REDUCTION OF OCULAR TENSION

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There are many different opinions as to the wisest methods of handling glaucoma, but it must be agreed that in most cases control of the intra-ocular tension is essential. If ocular tension cannot be kept near average by medication or if reliance on miotics is not feasible for any reason, surgical intervention can be resorted to. Surgeons have widely different views as to the choice of operations. For chronic simple glaucoma and for operative secondary glaucoma I prefer corneoscleral trephining, as I think that it offers the best chance for permanent reasonable control of the tension, with little operative trauma and only slight postoperative danger. For acute primary glaucoma my preference is either iridectomy or corneoscleral trephining, in case persistent medication will not normalize tension. In expressing these preferences I am not trying to decide for other surgeons or even at this time to advocate definite procedures for ordinary forms of glaucoma. But I should like to make it clear that I should not choose the traumatizing operation of cyclodialysis except in cases in which the condition is desperate and will not respond to less traumatizing and ordinarily effective procedures. If I sense the general opinion correctly, cyclodialysis alone is believed to reduce tension effectively, but the reduction is temporary. A relatively small number of surgeons would disagree and say that extensive, well performed cyclodialysis gives permanent control of tension, especially if performed early in the disease.

Otto Barkan [1] recently reported postoperative gonioscopic studies of fourteen eyes with primary glaucoma on which cyclodialysis had been performed. Of these hypertensive eyes, eleven showed favorable reduction of tension. The three eyes that failed to respond had forward reattachment of the root of the iris. It is obvious that such reattachment would not have taken place in an eye in which complete iridectomy had been performed. Doubt as to the possibility of complete iridectomy has been expressed, but microscopic examination of eyes on which iridectomy combined with cyclodialysis has been performed will remove such doubt. Figure 1 shows a section through a coloboma with the

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1. Barkan, Otto: On the Surgery of Glaucoma: Mode of Action of Cyclodialysis, Am. J. Ophth. **17**:21, 1936.

entire width of the iris absent as a result of the operations of cyclodialysis and iridectomy.

If there is generous cyclodialysis, presumably the ciliary body follows along with the iris up to the wound in the limbus when the surgeon makes traction on the iris with the forceps, and excision of the iris well up to its attachment to the ciliary body is possible This excision makes impossible the reformation of anterior synechiae.

In 1932 Wootton [2] read a paper before the American Ophthalmological Society on cyclodialysis combined with iridectomy in glaucoma simplex. In his paper he gave credit to Torok [3] and to Jervey [4] for the idea of separating the iris from the cornea before iridectomy. Wootton advocated early operation and thought, as Torok and Jervey did, that iridectomy performed immediately after the cyclodialysis prevented formation of anterior synechiae and made possible drainage through Schlemm's canal. He recommended the operation for simple glaucoma

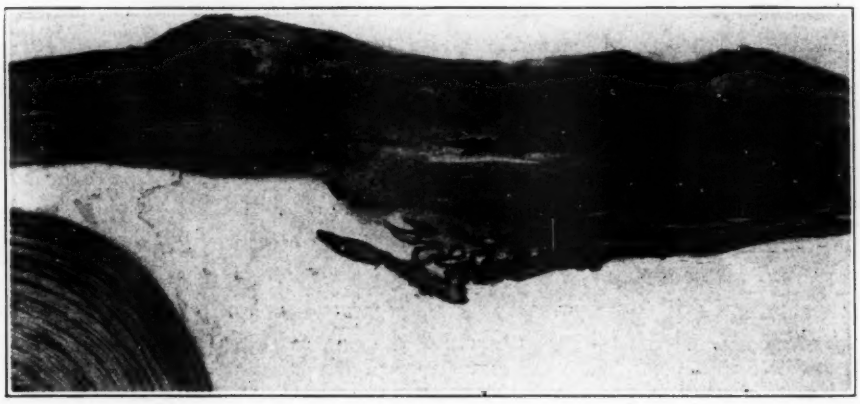

Fig. 1.—Photomicrograph of region of the ciliary body of an eye that has been operated on by iridectomy combined with cyclodialysis. The entire width of the iris, including the root, has been removed by the iridectomy.

only. After carrying out cyclodialysis through a scleral incision 6 mm. behind the limbus he sewed up the wound in the conjunctiva and made an incision with the keratome in the usual manner, independent of the dissection for the cyclodialysis. In discussing Wootton's paper I reported two cases in which the patient was operated on with slightly different technic.

I cannot accept the idea of making such an operation one of choice for simple glaucoma, but choose to perform trephining in such

2. Wootton, H. W.: Cyclodialysis Combined with Iridectomy in Glaucoma Simplex: A Preliminary Report, Tr. Am. Ophth. Soc. **30**:64, 1932.

3. Torok, Ervin: Iridectomy in Glaucoma: A New Technique, Arch. Ophth. **52**:574, 1923.

4. Jervey, J. W.: Sclero-Post-Iridectomy, a Rational Operation in Glaucoma: Report of a Case, Tr. Am. Ophth. Soc. **25**:160, 1927.

cases and leave the traumatizing iridectomy combined with cyclodialysis for the cases in which the condition is desperate and will not respond to the less traumatizing operations, such as trephining, the Lagrange operation and iris inclusion.

The chief points in which this procedure differs in technic from Wootton's operation are a more extensive cyclodialysis carried out from a scleral wound farther from the cornea and incision with the keratome under cover of the conjunctival flap.

OPERATION

Anesthesia is produced by the instillation of cocaine hydrochloride or of para-normo-butylaminobenzol-di-methylamino-ethanol hydrochloride and epinephrine hydrochloride and a subconjunctival injection of procaine hydrochloride where the flap is to be dissected. A retrobulbar injection of procaine hydrochloride may be added. Anticipating iridectomy, the surgeon should choose an area of the iris that is in relatively good condition. In eyes fit for this operation incisions have usually been made above in previous operations; so some other site should be chosen. Either the upper temporal quadrant or the lower temporal quadrant, above or below the external rectus muscle, is convenient for manipulations. A rather large conjunctival flap is dissected up, and the sclera is bared up to the limbus. A scleral incision from 3 or 4 mm. long and from 8 to 10 mm. from the cornea is made with a cataract or discission knife. The incision should slant slightly toward the iris so that the spatula will slide easily along the scleral wall and so that the incision will be valvelike during the period of recovery. A sturdy angulated spatula is passed through the scleral incision and directed along the scleral wall and then along the posterior surface of the cornea until the tip is advanced nearly to the pupillary margin (fig. 2). The surgeon proceeds with the separation of the uvea from the sclera and cornea by rotating the round handle of the spatula (fig. 2 *B*). Then the conjunctival flap is lifted and the keratome made to enter the limbus under cover of the flap (fig. 2 *C*). The incision in the limbus should be long enough to allow for ample spread of the iris forceps and for a wide iridectomy. This may mean enlargement of the incision with scissors, which are entered under the conjunctival flap. An ample fold of iris is grasped with the forceps, and it is cut with the scissors hugging the globe closely, while good traction is made on the iris with the forceps. Thus the loosened ciliary body is pulled to the wound, and the iris is cut off in its entire width at its attachment to the ciliary body. If a small amount of iris tissue becomes pinched in the ends of the wound it should be freed with the spatula. The ciliary body then slips back to its position or slightly farther back than its original place of attachment to the sclera. The conjunctival wound is

sutured with fine silk, and solution of atropine sulfate is instilled into the eye (fig. 2 *D*). The use of atropine should be continued during the process of healing.

The cyclodialysis with the spatula involves bisection of vessels as well as of nerves, so a slight hemorrhage into the new small cavity between the ciliary body and the sclera and into the aqueous chamber is the rule. The vascular leakage usually does not recur, and it is not important. Hypotony follows the operation and persists for a time, occasionally for a long period.

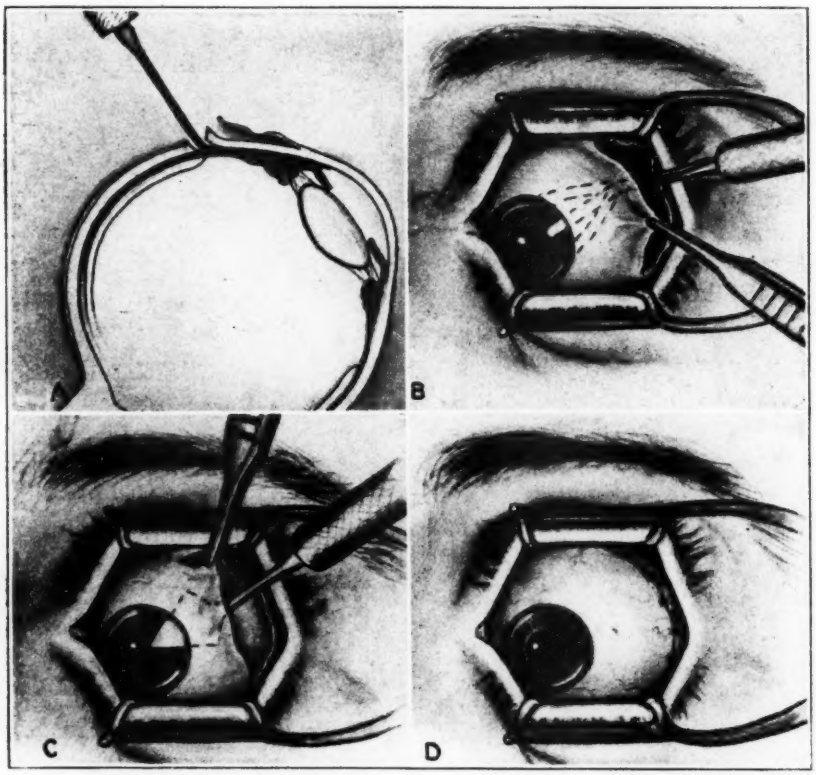

Fig. 2.—*A*, semidiagrammatic cross-section of the eyeball, showing frank anterior synechiae. The angulated spatula has been introduced through the sclera and has been passed between the sclera and cornea on one side and the ciliary body and iris on the other, with the tip extending into the anterior chamber. *B*, rotation of the round handle of the spatula causes separation of the uvea from the cornea and sclera over a wide area. *C*, incision of the limbus with the keratome under cover of the conjunctival flap. *D*, iridectomy has been performed and the conjunctival wound sutured. Adhesions between the root of the iris and the cornea have been destroyed over a large area.

During the last four years various members of the staff of the Eye Institute at the Columbia University-Presbyterian Medical Center have

performed cyclodialysis combined with iridectomy on fifty-seven eyes with far advanced glaucoma. In most of these eyes the condition was seemingly hopeless, and previous operations for glaucoma had failed. Of these fifty-seven eyes that had been operated on, thirty-one showed tension persistently lowered to 26 mm. or less, as measured with the Schiötz tonometer. Of the remaining twenty-six eyes, sixteen had reduced tension, but it was not thoroughly normalized. In one case persistent hypotony resulted. Eight eyes were enucleated after failure of iridectomy combined with cyclodialysis. In one eye the tension remained persistently high. When it is considered that the condition in practically all the selected eyes was desperate, this operation has made a good showing in the hands of several different surgeons, and its use seems to have been justified.

COMMENT

Iridectomy combined with cyclodialysis offers a fair chance for the reduction of ocular tension in seemingly hopeless cases of glaucoma.

The operation makes possible the removal of the root of the iris so that reformation of anterior synechiae cannot occur. It gives an opportunity for the escape of aqueous in two ways: first, through possible reestablishment of drainage through Schlemm's canal and, second, through possible permanent detachment of the ciliary body, with free access of aqueous to the cleft between the ciliary body and the sclera. In cases in which the condition is far advanced the chances of reestablishment of the original angle drainage probably are not good, so the additional chance of permanent drainage into the cleft made by the cyclodialysis is important.

The operation is gratifying in glaucoma occurring in aphakic eyes which do not respond favorably to other operations.

It is valuable in eyes that need discission of a secondary cataract or a false membrane but have no anterior chamber or an anterior chamber too shallow to allow of the necessary manipulation for cutting the membrane. The operation results in the formation of an anterior chamber and makes possible the necessary manipulation for discission.

A disadvantage of the operation is that the incision with the keratome for iridectomy is unpleasant and sometimes difficult on account of the softness of the eye resulting from the cyclodialysis and on account of hemorrhage into the aqueous chamber.

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ABSTRACT OF DISCUSSION

DR. JOHN O. MCREYNOLDS, Dallas, Texas: It is not necessary to confine oneself to a single procedure in the application of surgical measures for the relief of high intra-ocular tension. There may be many factors entering into the mechanism of increased tension, and because of these many different operations may be indicated.

Iridectomy accomplishes its function by opening up a better communication between the anterior and posterior aqueous chambers and the neighboring vitreous chamber. When properly performed it throws together the aqueous channels within the globe and improves the function of the ligamentum pectinatum. The essence of its value rests on its peripheral situation rather than on its extent. The pivotal point is the root of the iris, and an adequate, well executed iridodialysis is essentially similar in its action and is generally not followed by hemorrhage. The permanency of the effect seems better assured when there results the minimum of reaction which would invite inflammatory exudate that would later close up the channels provided.

Cyclodialysis goes a step further and supplies for the excess aqueous access to an auxiliary chamber in the supraciliary and suprachoroidal areas, where absorption may proceed for an indefinite and variable period. Thus it is that these two operations judiciously combined may effectively supplement each other.

I have found that these two procedures simultaneously performed can be carried out more easily by making the scleral incision farther forward than originally advocated by Heine. I prefer to make the incision about 2 mm. external to the limbus. Through this incision the cyclodialysis can be quickly and safely executed, and at the same time one can perform peripheral iridectomy, iridotomy or iridodialysis.

In approaching this operative field I like to proceed under a conjunctival flap or, better still, under an uncut conjunctival bridge.

The advantages of the conjunctival bridge and the conjunctival flap are obvious, as they secure more rapid union with the minimum hazard of infection.

If the scleral incision is placed close to the limbus it is possible to perform the necessary surgical procedures through a single incision, and this does not entail the difficulty of operating on a soft eye, as mentioned by Dr. Wheeler.

The cyclodialysis can be started with the spatula introduced through the scleral opening and carried downward between the sclera and the ciliary body and swept around in a circular direction to any extent which the special condition of the eye would suggest as necessary.

Dr. Frank E. Burch, St. Paul: Experience with Heine's cyclodialysis has led most ophthalmologists to the conclusion that this procedure is uncertain or not effective for permanent results in many cases. Dr. Wheeler's experience with the new technic of wide separation of iris adherent in the anterior angle preliminary to broad iridectomy to prevent adhesions, even though it may not always effect complete reopening of drainage through the sclerosed ligamentum pectinatum, has given encouraging results.

One who has not attempted this operation cannot discuss it intelligently, but since 54 per cent of patients with a seemingly hopeless condition have been entirely relieved and a further 28 per cent have shown encouraging results, as Dr. Wheeler has found, this method should be given a trial.

The technical difficulty of introducing a keratome in a soft eye with a shallow anterior chamber immediately brings to my mind the possibility of making the sclerotomy 3 mm. from the limbus over a width of 8 or 10 mm., separating the adhesions of the ciliary body and iris

directly with a spatula and then proceeding with the iridectomy. One wonders whether it is necessary to begin the cyclodialysis 8 or 10 mm. back of the limbus.

The ideal result in glaucoma can be attained only when tension can be sufficiently lowered with a minimum of trauma and a maximum of retained vision, i. e., vision equal to that which obtained previous to operation for primary glaucoma and vision equivalent to that which existed before an attack of acute or subacute glaucoma developed, provided, of course, that operation has not been too long delayed.

My own experience since 1930 has been concentrated on the Luunsgard modification of Holth's iridencleisis and now includes operations on one hundred and sixty-four eyes in suitable cases in one hospital and on approximately half that number by others and myself on the staff of the University Hospital. Luunsgard's technic involves a minimum of trauma and is suitable for most eyes with ordinary congestive and noncongestive glaucoma. I would not recommend it for buphthalmos or aphakia or for glaucoma following severe iridocyclitis. It is adaptable even for very acute glaucoma if one does an extensive iridectomy and incarcerates one pillar of the iris in the wound.

My experience during these past five years convinces me that one need not hold to the traditional reverence for the iris or fear any serious consequences of its permanent incarceration in an adequately covered sclerotomy wound. In the series of cases in which iridencleisis was performed by my associates and me no instance of sympathetic ophthalmia has occurred; severe iritis has followed this procedure in six instances only, and in these the condition has responded to foreign protein therapy and atropine. Hypotension occurred in seven instances. A second operation has been required nine times—on 5 per cent of all the eyes. There have been no instances of buttonholed conjunctiva—it was necessary to close a fistula only once. Thin blebs are rare and result only if the sclerotomy is made too near the limbus without splitting the sclera obliquely or if Tenon's capsule is not lifted with the conjunctiva or in case the latter is extremely atrophic. When subsequent operation for cataract has been necessary there has been no great technical difficulty in securing a conjunctival flap or bridge over the section.

On the whole, our results have been better than with trephining; there have been no late infections to date and, so far as our experience goes, apparently many less late cataracts than after the trephine operation.

On the other hand, although atropine is usually instilled after iridencleisis, it is occasionally found necessary to employ miotics for a considerable period after healing, and in nine instances it was necessary to perform a second operation.

My associates and I are convinced that iridencleisis is an admirable procedure which deserves a permanent place in surgical procedures for glaucoma, and we are certain that thus far our results are far better than with the trephine operation as a routine procedure.

Dr. H. W. Woodruff, Joliet, Ill.: Dr. Wheeler advocates this operation in the late stages of glaucoma. Emphasis should be placed on the fact that early operation by any well recognized procedure offers a good chance of saving vision.

Dr. Wheeler referred to an operation of Torok which he advocated several years ago. I was much interested in Torok's procedure and operated on a number of patients by his method. It enables one to remove the root of the iris by a certain technic, for instance, the use of a cataract knife instead of the keratome in making the incision. With the cataract knife and with the use of magnification, while it is not possible to get back at the root of the iris with the puncture, because the area of the iris is cone-shaped, the pupillary border of the iris is much nearer the center of the cornea. Therefore, an external incision cannot well be peripheral enough to reach the root of the iris, but the counterpuncture can correspond to the location of the root of the iris. I have proved that by operations on kittens' eyes.

When one is dealing with a pathologic condition the problem is different. In such instances again if the operation is performed sufficiently early one is still dealing with more nearly anatomic conditions, which render this operation more possible.

I wish to bring out one point which is not new but which has not been mentioned: In operations in which the results depend on external drainage one can help oneself and one's patient very much by massaging the eye, beginning this pressure the day after the operation and making it sufficiently forceful so that one can feel the eye soften under pressure. This should be done daily so that one is certain that the wound will not close at all; thus one secures permanent drainage.

Dr. Otto Barkan, San Francisco: I feel that a new era in surgical intervention for glaucoma is at hand.

One must learn to know the angle of the anterior chamber in the living by the new method of biomicroscopy and use it as a routine in indicated cases just as one uses biomicroscopy of the anterior segment.

One must learn to know the inside of the limbus, which is the functioning angle, and picture it in one's mind instead of picturing only the outside of the limbus where one makes the incision.

In the demonstration session I shall show slides of an operation that I have devised which restores the physiologic pathway for the intra-ocular fluids. I have developed a contact glass which makes it possible to incise under direct vision a blockage of the trabeculum which separates the aqueous chamber from Schlemm's canal. When this blocked trabeculum is opened and the physiologic pathway reestablished, the intra-ocular pressure drops to normal.

There is need of a procedure such as Dr. Wheeler says offers a fair chance in cases in which the condition is desperate. I have found reduction of tension to run nearly parallel to the extent of the cleft and wonder whether Dr. Wheeler's cyclodialysis reduces pressure in these cases by virtue of its great extent.

Dr. Sanford Gifford, Chicago: I wish to call attention to a group of cases which Dr. Wheeler mentioned briefly and which should be emphasized as a special group of cases in which the condition is desperate in which either cyclodialysis or Dr. Wheeler's modification of cyclodialysis is sometimes of great value. That is the group of cases in which glaucoma follows operation for cataract. Most ophthalmologists know that the ordinary filtering operations in such cases are very likely to be unsuccessful. In these cases there are certain reasons for the choice of cyclodialysis. Iridectomy has already been done in most

cases, so that it will not be necessary to carry out Dr. Wheeler's iridectomy at the same time.

Usually one of the pillars is slightly adherent to the cornea at the root. The site for cyclodialysis is chosen at the side of this pillar which is more forward than the other. If the pillars are equally forward, a site on the temporal side is chosen because it is more easily accessible.

The spatula is placed through the angle of the chamber, opposite the adherent pillar, and the pillar is free. At the same time the ciliary body in the area of the coloboma is free, and if iridectomy has not been done, one would think that Dr. Wheeler's procedure could well be combined with it. This, of course, is not uniformly successful. In many cases in which both pillars are adherent the operation may have to be repeated on the opposite side, but it seems to be definitely indicated in this type of case.

I do not believe in cyclodialysis as a procedure for chronic simple glaucoma. It usually has to be repeated one or more times and is not so permanently successful.

There is a slight modification in technic which both of us seem to have made at the same time, which was suggested by Solomon's use of the trephine in doing sclerotomy. Instead of using the trephine I perform sclerotomy with a scalpel and then make a small semicircular bite in the anterior of the scleral incision with a Holtz punch. This gives slightly more room in which to move the spatula in different directions. It is much more convenient to perform the operation through such a small semicircular sclerotomy.

Dr. Warren D. Horner, San Francisco: If in Dr. Wheeler's operation, after the first stage, that is, the cyclodialysis, has been completed, the anterior chamber should be found too shallow or the eye too soft to make the usual scleral incision into the anterior chamber, it seems to me that this could be easily done by the ab externo incision. In this one cuts down into the anterior chamber from the outside by short strokes of a keratome; this is a great deal like the incision in the sclera in ordinary cyclodialysis. The anterior chamber can be cut down on at its base and in sufficient width so that a good iridectomy can be done.

This operation, *iridectomia ab externo,* was devised by Foroni and popularized by Salzman.

Dr. John M. Wheeler, New York: I do not wish to be misunderstood in presenting this combination operation. I am exceedingly conservative in my attitude toward glaucoma. If it is possible and feasible to control the tension in a glaucomatous eye with miotics I favor the use of miotics. If it is necessary for the surgeon to operate I prefer conservative operation—relatively conservative operation. But every once in a while miosis and conservative operations fail. The operation that I have suggested is only for cases in which the condition is desperate and has not responded to the more conservative procedures.

TREATMENT OF ANGIOMA OF THE EYELID BY INJECTION OF SCLEROSING SOLUTIONS

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SARATOW, U. S. S. R.

Though angioma is usually a benign tumor, it sometimes degenerates into a malignant growth, and surgical intervention is necessary.

In about 65 per cent of the cases angioma is located on the face and therefore is mutilating. The second peculiarity of angioma is that it occurs in childhood in 80 per cent of the cases. Both these circumstances limit the method of treatment.

Naturally, angioma of the face has not only an indirect but a direct relation to the organ of sight. The statistical data of Maas (cited by Michel [1]) showed that the face in general was involved in 104 instances (81.5 per cent) and the eyelids in particular in 12 instances.

Holdin [2] stated (data from the Oncologic Institute, Leningrad) that angioma of the face occurred in 175 of 261 cases (67 per cent), in 16 per cent (28 cases) of which the eyelids were affected.

Beljaev [3] in 1925 reported the statistical data on hemangioma of the eye. In the literature he found that in 53 of 337 cases (15.7 per cent) the hemangioma was located on the eyelid.

Virchow (cited by Holdin) expressed the belief that angioma of the eyelid was "fissural." He employed this term because of the localization of the tumor near the former embryonic fissures of the face. He classified angiomas of this type as aural, nasofrontal, labial and palpebral. He advanced the theory that the appearance of hemangioma is dependent on defective development during embryonic life. Virchow affirmed that embryonic fissures readily undergo disturbance during the normal development of the organism.

An interesting drawing presented in the monograph by Holdin illustrates the typical localization of angioma of the face.

Various remedies have been employed in the treatment of angioma. Of these the surgical method is the oldest and most generally acknowl-

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1. Michel: Die Krankheiten der Augenlider, in von Graefe, A., and Saemisch, E. T.: Handbuch der gesamten Augenheilkunde, Leipzig, W. Engelmann, 1908, vol. 5.

2. Holdin: Haemangiomata and Their Treatment, Leningrad, The Oncologic Institute, 1935.

3. Beljaev: M. Rev., 1925.

edged. This method, however, cannot be used in the treatment of large angiomas, as it leaves mutilating scars.

Formerly, angioma was treated with cauterizing remedies. At first the red-hot iron was employed, which was replaced by Paquelin's apparatus and later by galvanocautery. These methods are still recommended by many authors, but they have the defect of leaving ugly scars.

Electricity employed in galvanocauterization is now largely used in the treatment of angioma. Electrolysis, proposed by Josef in 1912, has found the widest acceptance. The resulting scars are smooth and are less deforming than those with the earlier methods, but the slowness of the treatment and its painfulness are obstacles for many patients. The next stage in the development of electrotherapy was the use of currents of high frequency by means of a special diathermic apparatus producing electrocoagulation, electro-excision and electrodesiccation.

For cauterizing an angioma substances are used which act by their low temperature, such as those employed in cryotherapy. Middeldorf recommended the use of fluid air as a method of freezing. But the method had many defects and is now replaced by the use of solid carbon dioxide, termed carbon dioxide snow (Pusey).

In order to make the treatment of angioma bloodless, Desgranges, Vallette and Chassaignac (1856) proposed a method of treatment with injection of various fluids into the tissue of the tumor; e. g., they injected a solution of iron sesquichloride into the veins.

In the further development of this method, many authors have proposed various remedies, such as hydrogen peroxide, phenol, ammonium and sodium citrates and others. Many of these remedies are now abandoned or replaced by other substances. It is interesting to note that the impulse to use these remedies was an accidental observation of their effect on blood vessels. For instance, Sicard observed that the injection of a hypertonic solution of sodium chloride into blood vessels caused their obliteration. He proposed to inject first sodium bicarbonate and later a concentrated solution (20 per cent or more) of sodium salicylate. The latter remedy is now largely used. It can be injected into the veins and the subcutaneous tissue. The results are good. The painfulness of this method is its only defect. Andrews and Kelly [4] availed themselves of the sclerosing effect of sodium compounds on vessels by injecting a strong solution of sodium chloride, with good results. The effect on the vessels was the same as that with injection of sodium salicylate. Génévrier in 1922 injected quinine in the treatment of malaria and then began to use this remedy [5] in cases

4. Andrews, G. C., and Kelly, R. J.: Treatment of Vascular Nevi by Injection of Sclerosing Solutions, Arch. Dermat. & Syph. **26**:92 (July) 1932.

5. The formula was as follows: quinine hydrochloride, 4 parts; ethyl carbamate, 2 parts, and distilled water, 30 parts.

of varicose veins. Vandier in 1926 improved this method by using a solution of quinine and urea hydrochloride. These remedies are usually injected into the lumen of a blood vessel. On injection into the surrounding tissue they cause necrosis. On the contrary, injection into the connective tissue of other remedies, such as from 60 to 70 per cent alcohol and absolute alcohol (Schwalbe), solution of formaldehyde (Morestin, 1914) and boiling water (Reder, cited by Moser [6]), give favorable results, but if these substances are injected into the vessels they produce thrombosis and embolism.

In order to treat this question more fully, I must mention the method of Payr, which consists in the introduction of magnesium rods into the tissue of the tumor. By this means water in the blood is decomposed into oxygen and hydrogen. Oxygen combines with the magnesium and resolves the swelling, and hydrogen favors the coagulation of the blood.

The most modern and widespread method of treating angioma is radium therapy. The good results of this method are based on hundreds of observations. Mazzoni [7] treated 398 patients, and he preferred this method to all others. Fuhs [8] made observations on twice as many patients. The majority of the patients at the Oncologic Institute in Leningrad were treated with radium.

Which of the aforementioned remedies can find application in ophthalmologic practice? This question has been discussed in modern ophthalmologic literature by the following authors:

Amat,[9] Castroviejo [10] and Geronimi [11] recommended the treatment of angioma of the eyelid with electrolysis, with which they had good results.

Caspar [12] observed angioma of the eyelid in 6 patients, aged from 3 weeks to 1½ years. He successfully used freezing with carbon dioxide.

Mazzei [13] treated angioma of the lid in 3 cases with the injection of absolute alcohol (from eight to twenty injections of 0.1 cc.).

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6. Moser, E.: Deutsche med. Wchnschr. **50**:915, 1924.

7. Mazzoni, L.: Gior. ital. d. mal. ven. **65**:920, 1924; abstr., Zentralbl. f. d. ges. Ophth. **14**:293, 1925.

8. Fuhs, H.: Wien. med. Wchnschr. **83**:648, 1933; abstr., Zentralbl. f. d. ges. Ophth. **31**:64, 1934.

9. Amat, M. M.: Arch. de oftal. hispano-am. **32**:604, 1932; abstr., Klin. Monatsbl. f. Augenh. **89**:860, 1932.

10. Castroviejo, R.: Zentralbl. f. d. ges. Ophth. **14**:61, 1925; Arch. de oftal. **25**:552, 1925; abstr., Zentralbl. f. d. ges. Ophth. **16**:39, 1926.

11. Geronimi, E.: Schweiz. med. Wchnschr. **1**:589, 1931; abstr., Zentralbl. f. d. ges. Ophth. **26**:322, 1932.

12. Caspar, L.: Klin. Monatsbl. f. Augenh. **65**:584 and 588, 1920.

13. Mazzei, A.: Zentralbl. f. d. ges. Ophth. **14**:341, 1925.

Worms [14] and Caramazza [15] obtained satisfactory results in the treatment of angioma of the conjunctiva of the lid with diathermy in the form of electrodiscission, after previous electrocoagulation.

The most numerous reports concern radium therapy (Macdonald,[16] Degrais and Bellot,[17] Böck [18] and Liebermann [19]).

Marque [20] obtained good results by treating angioma of the lid and orbital cavity with roentgen rays. He considered the method to be good in the treatment of children.

Sclerosing therapy was best described by Weekers [21] and Weekers and Lapierre.[22] Weekers was the first to use retrobulbar injection of a solution of quinine hydrochloride and ethyl carbamate (1.5 cc.) in the treatment of varicocele of the orbital cavity. Weekers and Lapierre treated angioma of the lid with a solution of quinine hydrochloride and urea hydrochloride. The usual strength of solution, 7.5 per cent, was increased to 10 per cent and could be decreased to 5 per cent. The quantity of the fluid injected varied from 1 drop to 3 cc. The authors have reported observation on 4 patients, aged from several months to 12 years. In all cases excellent results were obtained.

Weymann [23] obtained a good effect with the same therapy in 3 cases.

Three years ago I had to treat a child with a large angioma. During the fourteen years of my work in the ophthalmologic clinic I had observed only the surgical treatment of angiomas which had the character of small nevi. No ugly scars resulted from treatment. In this case, however, in view of the extensive area of involvement, it was impossible to use the surgical method of treatment. Since the age of the patient compelled foregoing the use of electrolysis, my associates and I decided on sclerosing therapy, in which we were assisted by Dr. Machlin.[24]

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14. Worms: Arch. d'opht. **43**:733, 1926.

15. Caramazza, F.: Boll. d'ocul. **13**:742, 1934; abstr., Zentralbl. f. d. ges. Ophth. **32**:417, 1935.

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17. Degrais, P., and Bellot, A.: Arch. d'opht. **45**:783, 1928.

18. Böck, J.: Wien. klin. Wchnschr. **2**:1199 and 1462, 1931; abstr., Zentralbl. f. d. ges. Ophth. **26**:527 and 528, 1932.

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22. Weekers, M. L., and Lapierre, S.: Bull. Soc. belge d'opht. **68**:23, 1934; Arch. d'opht. **52**:14 (Jan.) 1935.

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REPORT OF CASES

CASE 1.—A girl 3 months of age was referred to us on Dec. 16, 1932, because of a "bloody tumor" on the lid. The mother stated that the child had a reddish

Fig. 1.—Photograph of the infant in case 1, showing the tumor of the eyelid.

Fig. 2.—Photographs of the patient in case 2, showing the appearance of the tumor (*A*) before treatment, (*B*) after several injections of the sclerosing solution and (*C*) after the last injection.

spot on the upper lid at birth. This spot was as large as a sunflower seed and was growing progressively larger. After a month it began to grow more rapidly and at last resembled a tumor.

Examination revealed a tumor of the upper lid of the left eye; it was red and soft and was adherent to the skin. The tumor occupied the entire middle portion of the lid and was 15 mm. in length. It produced a prominence of 6 mm. on the surface of the skin.

On December 20, 0.25 cc. of quinine and ethyl carbamate was injected into the tissue of the tumor. Three days later the tumor was harder.

On December 24, 0.5 cc. of the same fluid was injected. On this day the mother of the patient was obliged to leave the clinic on account of family circumstances. I could not observe the subsequent course of the disease. After a time the mother reported that the tumor gradually decreased and at last disappeared, leaving a scarcely marked rose-colored spot.

The result obtained with this patient gave us greater assurance in treating the condition in the second case, which occurred two years later.

CASE 2.—A girl 9 years of age was referred to us on Sept. 15, 1934, with the complaint of a tumor of the eyelid, which appeared when she was 1 year old.

Fig. 3.—Photograph of the infant in case 3, showing the appearance of the tumor before treatment.

Examination revealed that the tumor was located 1 cm. above the eyebrow of the right eye, of which it occupied the outer two thirds. It drooped over the upper lid and occupied its outer third in the form of a sac (6 cm. wide and 4 cm. long). The tumor formed a prominence of 1.7 cm. on the surface of the skin. The lateral extension formed a swelling of the temporal area (3 by 3 cm.). The entire tumor was soft and bluish and moved freely under the skin. It produced no pain. In the inferior part of the tumor enlarged blood vessels could be seen through the skin. The palpebral fissure was triangular, due to the drooping of the external third of the upper lid.

From September 22 till October 24 we gave seven injections of sclerosing fluid—four of 2 cc. of 12 per cent quinine di-hydrochloride and three of 3 cc. of 10 per cent sodium chloride. During this period of treatment we noted induration and gradual decrease of the tumor. By November 1 the palpebral fissure was wider open. The tumor decreased till it was only 3 by 3.8 by 1 cm. The swelling on the cheek also decreased to 2.2 by 1.4 cm. Between the inferior margin of the tumor and the upper lid the skin hung in a wrinkle. This wrinkle was beginning to smoothen out at the lifting of the lid. The whole tumor was hard. At

the site of the former injections the skin was adherent to the tumor; in the remaining portion it was freely movable.

After three months the swelling on the temple had disappeared, and the tumor had markedly decreased. From February 5 till March 7, 1935, we gave four injections of quinine di-hydrochloride, which caused further decrease in the size of the tumor.

After the last injection the skin became red and remained so for three weeks, when an abscess formed and burst at the site of the injection, leaving a small scar. The last photograph of the patient (fig. 2*C*) showed that the treatment can be regarded as efficacious. The tumor had disappeared, leaving a small swelling, which did not deform the face.

CASE 3.—A girl 5 months of age was under treatment at the time of writing. On Dec. 20, 1935, she was referred to the clinic. The mother stated that at birth a red spot the size of a pinhead was present on the upper lid. This spot gradually increased and after a time became a tumor. At the time of writing the tumor occupied nearly the whole upper lid of the left eye and measured 2.8 by 2.2 by 1 cm. The inferior margin of the tumor descended on the lower lid, covering it for at least 3 mm. The palpebral fissure was closed. It was impossible to evert the upper lid. The tumor was blood red and soft, and the skin covering it was thin and translucent.

On December 26 we injected 0.5 cc. of a 15 per cent solution of quinine di-hydrochloride; on December 29, 1 cc., and on Jan. 2, 1936, 1.5 cc.

Under the thinned skin the movement of the injected fluid could be seen. After three injections we noted necrosis of the skin, corresponding to the area of the tumor over which the solution was spread. The tumor became harder than before the injections.

It is premature to speak of the effect of the treatment in this case, but the character of the angioma and the thinning of the skin (like tissue paper) must be noted. The pressure of the injected solution caused the necrosis of the thinned skin, which in the future will cause a scar. It will not disturb the function of the eyelid, however. After the healing of the scar the injections will be continued.

CONCLUSIONS

From a review of the literature and our own observations the following conclusions are reached:

1. Sclerosing therapy is a safe method of treatment.

2. It does not require complicated equipment but can be carried out by any oculist in any hospital or in the ambulance.

3. This method is valuable because of its effectiveness and simplicity.

POSTOPERATIVE GLAUCOMA

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Rydel,[1] professor of ophthalmology at Krakow, Poland, was apparently the first to make exact observations on postoperative glaucoma. And in 1865 Sir William Bowman[2] warned that "the vitreous humor should not be encouraged to come through the opening made in the capsule . . . wide excursions of the needle . . . are apt to disturb the vitreous and cause it to press thence afterwards through the pupil occasioning irritation of the iris by displacement, and sometimes consequent heightened globe-tension of the glaucomatous type. . . . Such glaucomatous tension is particularly apt to come on after needle operations."

In 1869 von Graefe[3] called attention to glaucoma following cataract extraction and discission and noted that it more frequently followed discission after simple extraction than discission after combined operations. He attributed the glaucoma to two causes: (1) the retention from secondary capsular cataract of cortical material, which after needling is liable to swell and irritate the posterior surface of the iris and ciliary organs; (2) the displacement of the capsule with traction and irritation of adherent ciliary processes, especially when the capsule is tough.

Priestley Smith[4] in 1879 recorded a case which he attributed to a plastic iritis which had bound down the iris to the thickened capsule.

In 1888 Stoelting[5] and Schleztendal[6] described a case following linear extraction with incarceration of the lens capsule and the iris in the extraction cicatrix. They attributed the glaucoma to traumatic choroiditis and consequent lymph stasis between the choroid and the sclera, thus causing the vitreous to bulge forward and close the angle of the anterior chamber.

From the Ophthalmic Service of Dr. Webb W. Weeks, Bellevue Hospital.

From a thesis submitted to the Faculty of the Graduate School of Medicine of the University of Pennsylvania in partial fulfilment of the requirements for the degree of Master of Medical Science (M.Sc. [Med.]) for graduate work in ophthalmology.

1. Rydel, quoted by Wicherkiewicz, M.: Ann. d'ocul. **132**:5, 1904.
2. Bowman, William: Ophth. Hosp. Rep. (pt. 4) **4**:365, 1865.
3. von Graefe, A.: Arch. Ophth. **15**:221, 1869.
4. Smith, Priestley, quoted by Collins, E. T.: Tr. Ophth. Soc. U. Kingdom **10**:108, 1890.
5. Stoelting: Ophth. Rev. **7**:138, 1888.
6. Schleztendal: Klin. Monatsbl. f. Augenh. **26**:91 (Feb.) 1888.

In 1889 Natanson [7] divided postoperative cases of glaucoma into two main groups:

1. Cases in which glaucoma appears within several weeks or months after the operation. This is the acute or subacute type of glaucoma. This type occurs the most frequently. The prognosis is relatively favorable if the iris is not gravely affected. Circumstances favoring its appearance are intra-ocular hemorrhage, iritis and incarceration or herniation of the iris or capsule in the wound. He called this type secondary glaucoma.

2. Cases in which glaucoma occurs several years after the operation. In most of the cases the condition is primary, idiopathic, independent of the operative procedure. He called this type primary glaucoma.

He stated that the lens did not play an important rôle and believed with von Graefe that the simple extraction predisposed to postoperative glaucoma because of the danger of incarceration of the iris.

Collins [8] in the same year reported 10 cases following cataract extractions: 3 after needling, 3 after iritis with keratic precipitates and 4 after slight iritis. In these cases the onset was noted from three to twenty-one months after operation. All followed iridectomies. He expressed the belief that adhesion of the lens capsule to the corneal cicatrix predisposes the eye strongly to a subsequent attack of glaucoma and that in some cases adhesion combined with entanglement of the iris is alone sufficient to light up an attack; in others it requires additional irritation such as that caused by discission or by an attack of kerato-iritis. As other factors he mentioned the presence of large quantities of cortex in the anterior chamber and the use of discission needles not sufficiently conical to plug the wound.

In discussing the aforementioned paper, Priestley Smith stated that postoperative glaucoma is always secondary glaucoma and is due to synechiae leading to obstruction of the filtration angle.

In 1891 Buller [9] reported 3 cases—one occurring five years, and another two and a half years, after discission. In another case, in which there was delayed healing due to trauma, the condition yielded nicely to treatment with miotics. He gave the possible causes as an entanglement of the iris, the presence of a thick capsule or the use of the eyes too soon after operation.

The following year H. Knapp [10] reported 10 cases of glaucoma following discission for secondary cataract and remarked that the best

7. Natanson: Abstr., Arch. d'opht. **10**:282, 1890.
8. Collins, E. T.: Tr. Ophth. Soc. U. Kingdom **10**:108, 1890.
9. Buller, F.: Am. J. Ophth. **8**:313 (Oct.) 1891.
10. Knapp, H.: Arch. Ophth. **21**:293, 1892.

operation for cataract is simple extraction with a small peripheral opening. In 1894 H. Knapp [11] presented 16 more cases of glaucoma, most of which had occurred from one to sixteen days postoperatively. However, 2 cases occurred after twelve and fifteen months, respectively. He gave as the possible causes: the presence of much lens material in the anterior chamber, the deep incision into the vitreous and *eine ausgiebige Spaltung der Kapsel* (an outpouring rupture of the capsule).

Rennecke [12] agreed with Natanson that glaucoma after a smooth operation and an uneventful postoperative course is of the primary type and independent of the operation. He presented several cases occurring from fourteen months to eight years after cataract extractions and found that preliminary iridectomies had no effect on the incidence of postoperative glaucoma, quoting Mittermaier with 10 patients who had preliminary iridectomies and 10 who did not have them, and Collins whose 10 patients all had preliminary iridectomies (vide supra). In 1896 Collins [13] cited 11 more cases and reiterated his belief that all postoperative glaucoma is due to obstruction at the angle.

Mitchell [14] reported 2 cases of glaucoma following extraction; both patients were cured by iridectomy with hook though the vision of one patient was lost. No cause for the glaucoma was given.

H. Knapp [15] also recommended iridectomy with hook for glaucoma in an aphakic eye, which, he stated, occurs following discission in about 1 per cent of cases and no less after extraction of primary cataract. Risley [16] reported a case occurring three years after extraction, which was due to gluing of the iris to a tough capsule, and in which a cure was effected by iridectomy. Taylor [17] reported a case in which "the agony was changed to perfect ease" by incising the sclera and puncturing the hyaloid membrane, letting out a few drops of vitreous. He cited Hausen as habitually puncturing the hyaloid fossa during extraction in order to secure a clear pupil.

Da Gama Pinto [18] stated that glaucoma followed about 2 per cent of 326 discissions after 529 cataract extractions.

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11. Knapp, H.: Arch. f. Augenh. **30**:1, 1894.

12. Rennecke, H.: Glaukom in aphakischen Auge, Inaug. Dissert., Berlin, C. Vogt, 1893.

13. Collins, E. T.: Researches into the Anatomy and Pathology of the Eye, London, H. K. Lewis, 1896, p. 107.

14. Mitchell, S.: Ophth. Rec. **6**:355 (July) 1897.

15. Knapp, H., in Norris, W. F., and Oliver, C. A.: System of Diseases of the Eye, Philadelphia, J. B. Lippincott Company, 1898, vol. 3, p. 786.

16. Risley, S. D.: Am. J. Ophth. **16**:328, 1899.

17. Taylor, C. B.: Lancet **2**:734, 1900.

18. da Gama Pinto, J.: Ann. d'ocul. **117**:122, 1897.

Elschnig [19] in 1903 reported a case in which as a consequence of incarceration of the iris and slow healing of the wound a corneoscleral epithelial ingrowth occurred with epithelialization of the anterior and posterior chambers. Wootton [20] reported similar cases requiring enucleation of the involved eyes.

Dalén [21] in 1901 reviewed the literature and collected all the hitherto 96 published instances, to which he added 12 of his own. He found that in every case there were adhesions of either the iris or the capsule of the lens to the corneal scar.

Dupuy-Dutemps [22] disputed Natanson's and Rennecke's contention that glaucoma coming long after operation is primary. This may be true in aged persons, he contended, but how about adolescents? He quoted Bronner,[23] who reported 4 cases in the postoperative course of 40 successive extractions for high myopia. He also reported a case occurring in a 29 year old woman in which the glaucoma was due to the slow retraction of the cicatrizing scar producing chronic irritation of the ciliary body, thus modifying the conditions of the secretion of the intraocular fluids. He gave as possible causes a poorly protected corneal cicatrix which acted as an opening for a low-grade infection, adhesions between the iris and the capsule of the lens, and an epithelial cyst in the anterior chamber.

On the other hand, Wicherkiewicz [24] in 1904 affirmed Natanson's classification and also his belief that neither absence of the lens nor absence of the iris hinders the development of increased tension by citing a case of Windsor [25] in which a cataract was extracted from an aniridic eye and the extraction was followed by glaucoma. He presented 6 cases of acute secondary glaucoma, 5 following extracapsular and 1 following intracapsular extraction with loss of vitreous. He did state, however, that in the majority of cases of postoperative glaucoma the condition is secondary and is always due to obstruction of the iridocorneal angle and consequently of the excretory passages. He believed that this was caused by faulty operation, inflammation, or retraction of the pupillary membrane toward the periphery after discission.

Bulson [26] reported 2 cases in which there were broad basal iridectomies and no capsular or iridic entanglements and supported Bartels in

19. Elschnig: Klin. Monatsbl. f. Augenh. **41**:247 (March) 1903.
20. Wootton, H. W.: Arch. Ophth. **45**:594, 1916.
21. Dalén, A.: Mitt. a. d. Augenklin. d. Carolin. med.-chir. Inst. zu Stockholm, 1901, no. 3, p. 75.
22. Dupuy-Dutemps: Ann. d'ocul. **132**:93, 1904.
23. Bronner, quoted by Dupuy-Dutemps.[22]
24. Wicherkiewicz, M.: Ann. d'ocul. **132**:5, 1904.
25. Windsor, T.: Ophth. Rev. **3**:146, 1867.
26. Bulson, A. E.: Tr. Am. Acad. Ophth., 1907, p. 236.

his theory that postoperative glaucoma might be due to a disturbance in the circulation of the anterior ciliary veins solely. Subsequent enucleation of one eye showed it to have turgid ciliary processes and distended choroidal veins, which, presumably, poured into the aqueous a serous fluid that escaped from the eye with greater difficulty and clogged the filtration angle.

J. Fridenberg [27] remarked that ". . . . glaucoma developing after operation is almost invariably due to mechanical conditions. It seems to imply faulty technic."

In 1910 A. Knapp [28] reported 6 cases—3 of traumatic and 3 of postoperative glaucoma—which he atrributed to adhesions of the capsule of the lens to the corneal wound.

Chance [29] reviewed the literature and found opinion to be overwhelmingly in favor of physical obstruction of the filtration angle as the primary cause of postoperative glaucoma. He found corneal sections to be more dangerous than sclerocorneal because of the danger of epithelial proliferation. He suggested that iridectomy should be basal and should leave no stump to become entangled with the ciliary processes and drawn forward in capsular-lenticular débris. Goldberger [30] presented a case in which the pathologic study suggested that the glaucoma was due to slowing of the blood current or to actual pressure of the blood in those parts where interference with lymphatic circulation might be responsible. At the same time Risley [31] presented 2 cases, and attributed the glaucoma to blocking of the filtration angle by cortical masses and the escape of semifluid vitreous into the anterior chamber through a rent in the posterior capsule caused by the operation.

Collins [32] reported another series of 9 cases: 3 of glaucoma due to iritis and 6 of glaucoma without iritis but with the angle of the anterior chamber closed off by contact of the root of the iris wth the periphery of the cornea. It is interesting to note that in 1 of the 6 patients there was a successful intracapsular extraction in which appeared an adhesion of the anterior hyaloid membrane of the vitreous. He maintained that adhesions of the capsule of the lens to the scar do not always produce increased tension since in 3 patients in whom this occurred it was only after discission that glaucoma developed. In these patients

27. Fridenberg, J.: Tr. Am. Acad. Ophth., 1907, p. 241.

28. Knapp, A.: Arch. Ophth. **30**:45, 1910.

29. Chance, B.: Ophthalmology **6**:565 (July) 1910.

30. Goldberger, H. G.: Ophthalmology **6**:570 (July) 1910.

31. Risley, S. D.: Ophthalmology **6**:572 (July) 1910.

32. Collins, E. T.: Tr. Ophth. Soc. U. Kingdom **34**:39, 1914; Brit. M. J. **2**:433, 1905.

the anterior synechiae predisposed the eye by making the anterior chamber shallow, and a still further advance as the outcome of needling determined its onset. Like Chance, he made the point that the amount of advance in the capsule of the lens and in the iris in front of it by adhesion to the scar of an extraction depends on the position of the incision. If the incision is in the cornea the advance is necessarily greater. He expressed the belief that an adhesion of the capsule to a limbal incision rarely causes glaucoma.

Lloyd [33] in 1919 reported a case of glaucoma due to trauma five days after operation in which sclerotomy and then trephining over the site of the iridectomy were unavailing. A trephining below, however, was crowned with instant success. It might be suggested that the efficacy of the last operation was due to its location where the iris was present and could hold back the vitreous which was thrust forward.

Stieren [34] reported 3 cases of glaucoma developing four months, eighteen months and ten years after cataract extractions and believed that the glaucoma was due to vitreous closing the spaces of Fontana and thus blocking the filtration angle. Lichtenberg [35] reported 3 cases occurring twenty-four hours, several months and five years after cataract extractions, and Ralston and Goar [36] reported 4 cases developing one month, two months and five years (2 cases) after cataract extractions. Both attributed the glaucoma to obstruction at the filtration angle.

Lambert [37] reported a case of spontaneous absorption of traumatic cataract in which glaucoma developed two years after discission, and Hardy [38] reported 2 cases occurring two years after extractions. The latter author considered "predisposition to glaucoma" as being a possible additional factor and thought preliminary iridectomy a good preventive.

Fage [39] held that the best preventive of postoperative glaucoma is intracapsular extraction because to a large extent it obviates the necessity of discission.

A. Knapp [40] assigned the chief causative rôle to the capsule of the lens and reported 6 cases of glaucoma in the course of 200 cataract extractions. Of these, 4 followed extractions; 1, preliminary iridec-

33. Lloyd, R. I.: Am. J. Ophth. **2**:601 (Aug.) 1919.

34. Stieren, E.: Am. J. Ophth. **4**:424 (June) 1921.

35. Lichtenberg, J. S.: J. Missouri M. A. **19**:345 (Aug.) 1922.

36. Ralston, W., and Goar, E. L.: South. M. J. **15**:581 (July) 1922.

37. Lambert: Arch. Ophth. **52**:268, 1923.

38. Hardy, W. F.: Am. J. Ophth. **9**:593 (Aug.) 1926.

39. Fage: Arch. d'opht. **43**:408 (July) 1926.

40. Knapp, A.: Rôle of Lens Capsule in Complications of Cataract Operation, J. A. M. A. **91**:1794 (Dec. 8) 1928.

tomy, and 1, discission. He stated the belief that certain eyes are predisposed to "capsule trouble," especially the small, hypermetropic eyes. He advised that in these the section should be scleral and made the point that one of the great advantages of the simple and of the intracapsular extraction consists in the necessary avoidance of adhesions of the hyaloid membrane or of the vitreous to the corneal scar. He stressed a proper toilet of the wound with replacement of entangled capsule and removal of all possible cortex as an excellent prophylaxis against postoperative glaucoma.

Covara [41] found glaucoma occurring soon after operation in from 0.5 to 1 per cent of cases but long after operation more frequently. In his experience it occurred equally after simple and after combined extraction. He recommended lateral iridectomy or, better still, cyclodialysis. Amin Bey [42] reported a case following discission in which a cure was obtained by trephining, vision being restored from perception of light to 6/18, corrected. And Morax [43] reported 2 cases. In one there was a slow closure of the wound, and the glaucoma was cured by sclerecto-iridectomy, and in the other there was partial prolapse of the iris and the eye finally had to be enucleated.

Wolfe [44] reported 5 cases. All the patients were benefited by iridencleisis combined with Holth's punch. He stated that he had never encountered glaucoma following an intracapsular extraction that was completed in toto. Weill, quoted by Koby,[45] expressed the belief that glaucoma following needling is due to invasion of the anterior chamber by vitreous, and Butler [46] cited examples of glaucoma following needling of the lens which was due purely to physical obstruction at the filtration angle.

While the foregoing review is not offered as absolutely complete, it is a fairly comprehensive study of the literature on postoperative glaucoma from the time the condition was first recognized to the present day. It shows that an overwhelming majority of previous observers believed the cause of postoperative glaucoma to be obstruction at the filtration angle. Only a few give explanations not pointing to physical obstruction.

With the object of comparing experiences in the ophthalmic service at Bellevue Hospital as to the percental occurrence, the etiology and the

41. Covara, V.: Atti. d. r. Accad. d. fisiocrit. di Siena **3**:679, 1928.

42. Amin Bey, M.: Bull. Ophth. Soc. Egypt **22**:70, 1929.

43. Morax, V.: Bull. et mém. Soc. franç. d'opht. **43**:84, 1930.

44. Wolfe, O.: Am. J. Ophth. **14**:769 (Aug.) 1931.

45. Koby, F. E.: Slit-Lamp Microscopy of the Living Eye: Early Diagnosis and Symptomatology of Affections of the Anterior Segment of the Eye, ed. 2, Philadelphia, P. Blakiston's Son & Co., 1930, p. 309.

46. Butler, T. H.: An Illustrated Guide to the Slit Lamp, New York, Oxford University Press, 1927, p. 121.

treatment of postoperative glaucoma with that of previous investigators a study of the cases which my associates and I have observed at Bellevue Hospital was undertaken. From Jan. 1, 1923, to Oct. 31, 1934, the patients with cataract admitted to the ophthalmic service numbered 856. On these patients 1,629 operations were performed—1,182 cataract extractions and 447 discissions. A review of the records discloses 24 cases of postoperative glaucoma. Cases 25 to 31, inclusive, are not of this series; the patients were admitted to the hospital with the diagnosis of glaucoma, but the operations had been performed at other hospitals. These cases are included here for purposes of interest but do not figure in our statistics unless so indicated. The tensions were all taken with the Schiötz tonometer. A short résumé of each case follows.

CASE HISTORIES

CASE 1.—K. L., a woman aged 75, was admitted to the hospital on June 27, 1925, with a senile cataract in each eye and iritis of long standing in the right eye. Extraction of the cataract in the right eye was followed by hemorrhage into the anterior chamber, incarceration of the pillars of the iris and slow healing of the wound. On July 20 combined extracapsular extraction of the cataract in the left eye was done. Again the postoperative course was stormy, with iritis and hypopyon developing in the left eye. The patient was finally discharged with both eyes quiet and the tension in both eyes normal. On October 19 she was readmitted because of pain in the left eye. The tension in the left eye was 34.

Examination of the left eye disclosed a firm secondary membrane and some capsular tags caught in the operative wound. The tension yielded to treatment with hot compresses and miotics. On November 25 Wheeler's discission was done in the left eye, without ensuing complications. On discharge the tension in both eyes was normal. The patient was seen again on May 11, 1926, at which time the tension in both eyes was still normal. She has not been seen since.

CASE 2.—F. B., a man aged 60, was admitted to the hospital on Sept. 11, 1927, with the diagnosis of senile cataract in each eye. The tension in the right eye was 20 and that in the left 16. Both irides were atrophic. A preliminary iridectomy was done in the right eye on September 12, and extracapsular extraction of cataract in the right eye on October 1. On December 5 the patient returned with a tension of 40 in the right eye and a tension of 22 in the left.

The slit lamp disclosed that a thick secondary membrane was present in the right eye. The site of the operative wound was normal. The tension in the right eye yielded to conservative treatment with miotics, and on December 27 Wheeler's discission of the secondary cataract in the right eye was done. The tension remained normal. On January 9 examination of the fundus of the right eye revealed vitreous opacities and glaucomatous cupping. The patient was seen again on March 2, 1928, at which time the tension in both eyes was normal. The vision in the right eye was 16/100+1 with correction. The patient has not been seen since.

CASE 3.—A. F., a woman aged 66, was admitted on June 4, 1928, with the diagnosis of senile cataract in each eye. The vision in each eye was 5/200 and could not be improved. The tension in both eyes was 18. Two-stage extracap-

sular extraction of cataract was performed in the right eye. The postoperative course was stormy, resulting in a thickened, vascularized cornea. On October 4 extracapsular extraction of cataract was done in the left eye, without ensuing complications. On October 13, however, an increase of tension in the left eye was noted, and atropine was withdrawn. The tension dropped to normal, and atropine therapy was resumed. Immediately the tension rose, and the patient complained of pain. Atropine was again withdrawn, and the eye gradually cleared up, though slowly. On December 20 Wheeler's discission for secondary membrane was done in the left eye, with no sequelae. The patient was discharged on December 26 with the tension normal in both eyes. In the right eye there was perception of light. In the left eye the vision was 16/100 with correction. The patient has not been seen since.

CASE 4.—J. S., a man aged 67, was admitted to the ophthalmic service in October 1930 with the diagnosis of senile cataract in each eye and trachoma of long standing. Preliminary iridectomy was performed in each eye. Extracapsular extraction of the cataract in the right eye was done, during which vitreous was lost. The postoperative course was long, and exacerbation of the trachoma in the right eye occurred with formation of an abscess in the lower lid, which had to be incised. The patient was finally discharged on Jan. 5, 1931, with both eyes quiet and the vision in the right eye 16/200.

He was readmitted in April 1931 with the diagnosis of secondary cataract in the right eye, hypermature cataract in the left eye and low grade trachoma in both eyes, which appeared quiescent. The lids were treated with mild astringents and appeared normal. Intracapsular extraction of the cataract in the left eye was done on May 2. Four days later the tension in the left eye was 1+. The left eye was treated conservatively, and the patient was finally discharged on July 2. The tension in the right eye was 22 and that in the left 27.

The patient was readmitted on September 1 with the tension of the left eye 45. The slit lamp disclosed adhesions of the iris to a thick secondary membrane which had formed in the left eye. Ziegler's discission was done in the left eye; the opening promptly closed, and the eye continued hard. Cyclodialysis was then done in the left eye, and the patient was discharged in due time with the tension in both eyes normal.

On May 11, 1932, he was readmitted with a diagnosis of secondary cataract in each eye and secondary glaucoma with iridocyclitis in the left eye. The discission opening in the left eye was found closed, and the tension in the left eye was 38. There was no perception of light. The left eye was enucleated, and the patient was discharged on July 25.

CASE 5.—C. S., a man aged 65, was admitted on June 15, 1933, with the diagnosis of mature cataract in the right eye and hypermature cataract in the left eye. The tension in both eyes was normal. Vision was reduced to counting fingers at 1 foot (33 cm.), with no improvement. Extracapsular extraction of the cataract in the left eye was done, and the patient was discharged with a large amount of lens material in the anterior chamber. He was readmitted on September 25 complaining of pain in the left eye. Examination disclosed a thick secondary membrane in this eye. The tension was 45. Paracentesis of the eye was done on the day of admission and Ziegler's discission on September 28. The patient was discharged on October 10 with the tension normal. He was seen again on March 8, 1934, at which time the tension in both eyes was still normal.

CASE 6.—O. L., a man, was admitted in July 1932 for combined extraction of senile cataract in the right eye and preliminary iridectomy in the left eye. He was readmitted on November 8 with vision of 16/85 in the right eye and vision of 16/65 in the left eye. The tension in the right eye was 30 and that in the left 15.

Examination disclosed a thin secondary membrane and an incarceration of the temporal pillar of the iris in the right eye and a mature senile cataract in the left eye.

On November 9 discission of the secondary cataract in the right eye was done and on November 18 extracapsular extraction of the cataract in the left eye. The patient was discharged on November 30 with the tension in both eyes normal. On Jan. 18, 1933, he was readmitted with vision of 16/70, corrected, in the right eye and of 16/40, corrected, in the left eye. The tension in the right eye was 35 and that in the left 25. Incarceration of the pillar of the iris in the right eye was again noted, and on January 19 iridectomy and freeing of the pillar of the iris were done. The patient was discharged on January 26 with vision of 16/40, corrected, in the right eye and the tension in both eyes normal. He has not been seen since.

CASE 7.—F. F., a woman aged 55, was admitted in November 1932 with the diagnosis of senile cataract in the left eye. There was vision of 16/32 in the right eye with perception of light in the left eye. The tension in both eyes was normal. Two-stage extracapsular extraction of the cataract in the left eye was done, and the patient was discharged on December 3 with the eye quiet, the anterior chamber clear and the tension in both eyes normal.

In January 1933 she was readmitted with the diagnosis of thick secondary cataract and posterior synechiae in the left eye. The tension in the right eye was 26 and that in the left 35. Ziegler's discission was done in the left eye, and the tension promptly subsided to normal. The patient was discharged with vision of 16/20, corrected, in each eye and the tension normal. The tension in both eyes has been normal since.

CASE 8.—M. S., a woman aged 72, was admitted on Nov. 16, 1932, with an immature senile cataract in each eye. The vision in each eye was 16/70. Preliminary iridectomy was done in the left eye on November 21, and combined extracapsular extraction of the cataract in the right eye was done on Dec. 11, 1933. Much soft lens material was left in the anterior chamber. On December 21 another patient pushed his shoulders into the right eye and the iris prolapsed, with secondary glaucoma ensuing. The prolapse was cut off, and a small amount of lens material was irrigated out of the anterior chamber, but the tension in the right eye continued up to 45 despite subsequent treatment with miotics. The patient was finally discharged on Jan. 31, 1934, with the tension in the right eye still up and was instructed to use miotics at home. The vision in the right eye was 20/30 + 1 with correction; that in the left eye was 12/100, with no improvement.

The patient was seen again on May 1, 1935, at which time the right eye was quiet and the tension normal. On June 11 the tension of the right eye was 22, and the vision was 16/30—2. On July 5 the tension of the right eye was 35, and the eye appeared white and quiet. The patient was ordered to resume treatment with miotics.

CASE 9.—F. L., a man aged 67, was admitted on Dec. 14, 1932, with a history of failing vision in both eyes, more marked in the left. The vision in the right

eye was 16/100; there was perception of light in the left eye. Combined extracapsular extraction of the cataract in the left eye was done on December 22, during which a small amount of vitreous was lost. Preliminary iridectomy was done in the right eye on Jan. 4, 1933. On January 12 the patient was discharged with both eyes in good condition.

On January 26 the patient was readmitted with the tension of the left eye 35. Examination disclosed vitreous in the anterior chamber and a capsulolenticular membrane in this eye. The patient refused operation on the eye but permitted extracapsular extraction of the cataract in the right eye on December 14. This was without complication or sequela. The tension in the left eye continued elevated, and the patient finally consented to discission on March 23, 1934. He was finally discharged with the tension in both eyes normal. He has not been seen since.

CASE 10.—J. S., a man aged 70, was admitted on Jan. 7, 1934, with a senile cataract in the right eye and a secondary cataract in the left eye. He gave a history of suffering from mild diabetes. The vision was 16/100 in the right eye and 16/30, corrected, in the left eye. The tension in the right eye was 22 and that in the left 25. Extracapsular extraction of the cataract in the right eye was done on Jan. 8, 1934. Much soft lens material was left in the anterior chamber. The convalescence was uneventful, and the patient was discharged with the tension in the right eye 20 and vision ability to count fingers at 5 feet (152 cm.).

On March 27 the patient was readmitted complaining of pain in the right eye. Examination disclosed the tension in this eye to be increased. The slit lamp showed capsular tags and the nasal pillar of the iris caught in the operative wound. The lens material was all absorbed. On March 28 capsulectomy was done in the right eye, and the patient was discharged on April 23 with the tension in both eyes normal. On May 9 he returned for refraction, and vision of 16/40+3 was obtained in the right eye. The vision in the left eye was 16/40 with correction. The tension in the right eye was 48 and that in the left 35. In the right eye capsular remnants were still found adherent to the wound. A secondary membrane was also present. The patient refused admission to the ophthalmic service, and miotics were prescribed. On July 11 the patient was readmitted complaining of pain in the right eye. The tension in the right eye was 41 and that in the left 25. Capsulectomy and discission were done in the right eye on July 18, and the tension subsided at once. The patient was discharged and not seen until October 7, when he was again admitted for increased tension in the right eye. The vision in the right eye was perception of hand movements at 1 foot, and in the left, 16/50 with correction. Examination disclosed that the iris in the right eye had prolapsed and that the opening in the secondary membrane had closed again. On October 12 discission and anterior sclerectomy were done in the right eye; the prolapsed iris was also cut off. The patient was discharged on October 22 with a good filtering bleb in the right eye and the tension in both eyes normal.

On May 22, 1935, the tension in both eyes was up.

CASE 11.—T. E., a man aged 49, was admitted on Aug. 7, 1934, with a history of failing vision in the right eye. Extraction of cataract had been done in the left eye in 1931 and preliminary iridectomy had been done in the right eye in 1933, both in another hospital. The diagnosis was mature senile cataract of the right and aphakia of the left eye. Vision was perception of hand movements at 2 feet

(61 cm.) in the right eye and 16/20 with correction in the left. On August 17 extracapsular extraction of cataract was done in the right eye. Ten days later the patient was discharged with the right eye showing moderate injection, the pillars of the iris in place and a small amount of lens material in the anterior chamber. The vision in the right eye was perception of hand movements at 1 foot, and the tension was normal.

On September 13 the patient was readmitted, complaining that he had suffered from pain in the right eye since leaving the hospital. Examination of the right eye disclosed ciliary injection, lens material still present in the anterior chamber and the pillars in place. The tension was 56 and the vision was 16/15—2 with correction. Under miotics and hot compresses the tension varied between 12 and 65; it was usually highest in the morning and lowest in the afternoon. On October 12 corneoscleral trephination was done. The tension remained normal, and the patient was discharged on October 24 with vision of 16/30 in the right eye. On November 12 the tension in the right eye was up to 30. There was no pain in the eye. Pilocarpine hydrochloride and massage were prescribed, and the tension in the right eye has been normal since.

CASE 12.—L. B., a woman aged 50, was admitted on Dec. 5, 1932, with a history of having had a cataract extracted from the left eye about two years prior to admission. The vision in the left eye had been good for four months and had then begun to fail. There was no pain. Two weeks prior to admission the left eye had become painful. Examination disclosed incarceration of the temporal pillar of the iris in the left eye. The ophthalmoscope showed temporal pallor and cupping of the disk. The vision in the right eye was 16/32 and there was perception of light in the left eye. The tension in the right eye was 22 and that in the left 55. The left eye was treated conservatively with hot compresses, miotics and massage, and the tension became normal, the patient being discharged on December 11 without operation.

On Sept. 12, 1934, she was readmitted. The vision in the right eye was 16/50, and in the left eye there was perception of light. The tension in the right eye was 26 and that in the left 65. On September 13 cyclodialysis was done in the left eye, and the incarcerated pillar of the iris was freed. The tension in the left eye became normal, and the patient was discharged on September 22. The tension in both eyes has been normal since.

CASE 13.—C. N., a man aged 74, was admitted on July 3, 1933, with a history of failing vision in the left eye since September 1931. He had had a cataract extracted from the left eye in February 1929 and one from the right eye in September 1930. Examination disclosed incarceration of both pillars of the iris in the left eye. The vision in the right eye was 16/20, and with the left eye he could count fingers at 2 feet. The tension in the right eye was 20 and that in the left 30. Corneoscleral trephination of the left eye was done on July 5, and the patient was discharged on September 26 with the tension in both eyes normal. On December 8 the tension in both eyes was still normal. The patient has not been seen since.

CASE 14.—A. G., a man aged 63, was admitted on Sept. 16, 1933, because of failing vision in the left eye. A senile cataract in the right eye had been extracted in August 1932. The vision in the right eye was perception of hand movements at 1 foot; in the left, 16/40 —2 with correction. The tension in the right eye was 33 and that in the left 25. Examination of the right fundus showed glaucom-

atous cupping. There was no pain. Perimetric studies of the visual fields showed contraction in the nasal portion of the fields, more marked in the right eye. The diagnosis was glaucoma simplex in both eyes. The slit lamp showed no abnormalities of the right eye, the operative site being clear. Trephining of the right eye was done on Sept. 21, 1933, and the patient was discharged with the tension in both eyes normal.

On November 8 he was readmitted for an extraction of the cataract in the left eye. Then discission for secondary cataract in the left eye was done on December 27. The postoperative course was uneventful, and the patient was discharged on Jan. 12, 1934, with the tension in both eyes normal. The vision in the right eye was 16/100, corrected, and the vision in the left eye was 16/40, corrected. The patient has not been seen since.

CASE 15.—R. B., a woman aged 65, was admitted on Nov. 11, 1933, with a history of having had a cataract extracted from the left eye in the previous May, and Ziegler's discission for a secondary cataract of the left eye in July. At discharge the "eye had been fine." But about a month later severe pain developed in the left eye and had recurred intermittently since. On admission the vision in the right eye was 16/30, and with the left eye she could count fingers at 3 feet (92 cm.). The slit lamp disclosed capsular tags adherent to the wound in the left eye and vitreous bulging into the anterior chamber. The tension in the right eye was 22 and that in the left eye 45.

Cyclodialysis of the left eye was done on November 12. As this proved unavailing, anterior sclerectomy was done in the eye on November 23. The patient was discharged on November 29 with the tension in both eyes normal.

On December 26 she was readmitted for recurrent pain in the left eye. The tension in the right eye was 22 and that in the left 56. Under miotics the tension in the left eye dropped to 33, and a modified Lagrange operation was done, with attempted capsulectomy, which was only partially successful. On Feb. 19, 1934, the patient was discharged with the tension in both eyes again normal.

On May 10 she was readmitted because of increased tension in the left eye, and therapeutic iridectomy was done in this eye. She was discharged with the tension in both eyes normal. She has used miotics since with no increase of tension in either eye.

CASE 16.—R. K., a woman aged 54, with diabetes, was admitted in October 1933 with the diagnosis of senile cataract in the right eye and aphakia with secondary cataract in the left eye. Preliminary iridectomy was done in the right eye on October 17 and extracapsular extraction of the cataract was done on November 13. She was discharged on December 4 with vision of 16/100 in the right eye, corrected, and the tension in both eyes normal.

On Jan. 20, 1934, she was readmitted. The vision in the right eye was 16/70, corrected, and that in the left 16/100. The tension in both eyes was 25. The slit lamp disclosed anterior synechiae and incarceration of the nasal pillar of the iris in the right eye, also a thin secondary membrane. Ziegler's discission was done in the right eye, and the patient was discharged four days later.

In May she was readmitted complaining that she had experienced pain in the right eye for the past three months. Examination showed that the discission opening was patent. The anterior synechiae and the incarceration of the iris were present as before. With the right eye she could count fingers at 1 foot. The vision in the left eye was 8/100. The tension in the right eye was 50; that in

the left, 25. On May 14 paracentesis of the right eye was done and on May 23 cyclodialysis. The patient was discharged on June 7 with the right eye quiet and the tension 35. The tension in the left eye was 25. There was perception of light in the right eye.

On September 28 the patient was seen again, at which time the right eye was white and quiet but with the tension still 35. Further operation was refused, and the tension has remained around 35 despite intensive treatment with miotics, massage and compresses.

CASE 17.—J. Z., a man aged 47, was admitted on Feb. 10, 1933, with a history of having had a cataract extracted from the right eye on Oct. 5, 1932. He complained of failing vision in the left eye. He was found to have a thick secondary cataract in the right eye and a thick central corneal opacity of long standing and a mature senile cataract in the left eye. He could count fingers at 1 foot with the right eye and fingers at 5 feet (152 cm.) with the left eye. The tension of both eyes was normal. He insisted on having the cataract in the left eye attended to first. Combined extracapsular extraction of the cataract in the left eye was performed. The postoperative course was uneventful. On March 3 de Wecker's discission and iridotomy were done in the right eye. Two weeks later the tension in the right eye was 40.

The slit lamp disclosed vitreous in the right anterior chamber. There were no other positive findings. The patient was treated conservatively with miotics, and the tension subsided somewhat. He was discharged on April 26 with vision of 16/40 and a tension of 30 in the right eye. The eye was white and painless. He was instructed to continue using the miotics. He has not been seen since.

CASES 18 and 19.—T. F., a man aged 51, was admitted in April 1923 with the diagnosis of bilateral senile cataract and secondary glaucoma. The tension in the right eye was 42 and that in the left eye 50. Combined extracapsular extraction of cataract was done in each eye with the loss of some vitreous from the right eye. Thick secondary cataracts developed in the eyes and on June 4 de Wecker's discission was done in the left eye. On July 17 Wheeler's discission was done in the right eye. The patient was discharged with the tension in both eyes normal and the vision of both eyes "improved."

On August 17 he was readmitted. Examination disclosed thick capsulolenticular membranes in both eyes, but the discission openings were patent. The tension in the right eye was 42 and that in the left 60. Sclerocorneal trephinings were done in both eyes within a week of each other, and the patient was finally discharged on October 10 with the tension in both eyes normal. He has not been seen or heard from since.

CASE 20.—D. G., a man aged 61, was admitted in April 1926 with the diagnosis of mature senile cataract in the left eye. Combined extracapsular extraction of the cataract was done, leaving much soft lens material in the anterior chamber. Three weeks later Wheeler's discission was done, but the opening closed. Wheeler's discission was done again two weeks later, and the tension in the left eye rose to 40. The glaucoma was treated with hot compresses and miotics, and the tension gradually subsided as the remaining lens material was absorbed. On August 14 the patient was discharged with the tension in both eyes normal. He was followed up for two years, during which time no increase in tension in either eye was noted.

CASE 21.—W. B., a man aged 79, had preliminary iridectomy of the left eye in April 1926 and extracapsular extraction of the senile cataract in this eye on

September 21. The postoperative course was uneventful, and the patient was discharged on October 3 with some soft lens material in the anterior chamber of the left eye and the tension in both eyes normal.

On December 5 he was readmitted for Wheeler's discission in the left eye because a secondary cataract had developed. Following operation, on December 10, he was discharged with normal tension in this eye. On December 18 he was readmitted complaining of severe pain in this eye. The slit lamp disclosed a thickened peripheral capsulolenticular membrane. The discission opening was widely patent. Miotics were prescribed for the eye, and the patient was discharged on Jan. 26, 1927, with the tension in the right eye 12 and that in the left 16. In January 1929 he was seen again, and the tension in both eyes was still normal.

CASE 22.—M. W., a woman aged 55, was admitted on July 28, 1930, with the diagnosis of iritis of long standing, posterior synechiae and mature cataract in the left eye. Two-stage extracapsular extraction of the cataract was followed by an uneventful postoperative course. On October 9 Wheeler's discission was done for a secondary cataract in the left eye. The reaction was severe, with acute iritis and glaucoma, the tension rising to 80. Examination disclosed a few small remnants of soft lens material in the anterior chamber and a thickened capsulolenticular membrane peripherally. Paracentesis was done in the left eye, and the tension subsided. On December 9 the patient was discharged with the tension in the left eye 28.

A week later she was readmitted. The tension in the left eye was 38. The discission opening was closed. Paracentesis and discission were done in the left eye on successive days, with subsidence of the tension for ten days, followed by another rise. In succession Wheeler's discission, trephining and iridotasis were done, and finally, on March 6, 1931, the tension in the left eye was normal and the eye appeared quiet. The patient was discharged on March 12 with the tension in the left eye 22 and the vision, perception of light. The patient has not been seen since.

CASE 23.—E. A., a man aged 58, was admitted on Jan. 15, 1935, with a history of poor vision in both eyes for several years. Preliminary iridectomy had been performed in the right eye two years previously. Examination disclosed an immature senile cataract in each eye. The vision in the right eye was 6/200 and that in the left 16/100. The tension in both eyes was normal. On January 17 extracapsular extraction of cataract was done in the right eye; on February 4 preliminary iridectomy in the left eye, and on February 19 Wheeler's discission for lenticular membrane in the right eye. Following extraction of the cataract in the right eye there was hemorrhage into the anterior chamber. The soft lens material in the anterior chamber absorbed very slowly. Following the discission in the right eye the wound remained open, and a small bead of vitreous was seen oozing from the wound for several days postoperatively. The wound was sealed off by cauterization. For several weeks thereafter the tension in the right eye remained around 40 but finally subsided to normal under miotics. On March 8 the patient was discharged with the tension in both eyes normal and some soft lens material in the anterior chamber of the right eye.

On March 12 he was readmitted complaining of pain in the right eye. The tension in the right eye was 65 and that in the left 22. Examination disclosed soft lens material in the anterior chamber. The discission opening was patent. The tension in the right eye remained up for about three weeks and then gradually

subsided under conservative treatment. It has remained down since. The vision in the right eye is 16/15 with correction, but perimetric studies of the visual field show moderate nasal constriction.

CASE 24.—M. A., a woman aged 56, was admitted on March 30, 1935, with a history of failing vision in the right eye and of having had a cataract extracted from the left eye in December 1934. Examination revealed a mature senile cataract in the right eye and a thick secondary cataract in the left eye. With correction the vision in the right eye was 16/40 and that in the left 16/50. Discission of the membrane in the left eye was done on April 2. On April 5 the patient complained of pain in the left eye, and vitreous was seen bulging into the anterior chamber. The tension in the left eye ranged from 65 to 35. Miotics and hot compresses were prescribed, as the patient insisted on being discharged. The vision in the right eye was 16/40 and that in the left 16/30. The tension in the right eye was 20 and that in the left 55. There was no pain. On May 16 the tension in the left eye was 29.

On June 13 the patient was again seen. At this time the tension in the right eye was 17 and that in the left 22. The vision in each eye was 16/30 with correction. The slit lamp showed vitreous still present in the anterior chamber. The tension has been normal in both eyes since.

CASES FROM OTHER HOSPITALS

CASE 25.—S. M., a man aged 63, was admitted on June 7, 1928, with a history of extraction of a cataract in the left eye in another hospital three months previously. The eye felt entirely well until the past several days, when pain began to be felt in it. The diagnosis at admission was acute iritis and secondary glaucoma in the left eye. The vision in the right eye was 16/40, and with the left eye he could count fingers at 1 foot. The tension in the right eye was 20 and that in the left 50. The slit lamp showed conditions essentially normal.

Corneoscleral trephination was done in the left eye, and the tension in this eye dropped to 20. The patient was discharged on July 5 with the left eye white and quiet and the tension normal. He has not been seen since.

CASE 26.—B. R., a man aged 55, was admitted on June 8, 1929, with the history of having had a cataract extracted from his right eye about four months earlier at another hospital. He complained that there had been pain in the right eye for the past several days. The slit lamp showed the operative site to be clear. The vision in each eye was 3/200. The tension in the right eye was 37 and that in the left 17. Ophthalmoscopic examination showed many small retinal hemorrhages in the right fundus. Corneoscleral trephination was done in the right eye on June 21, and the patient was discharged on July 3 with the tension in both eyes normal. He has not been seen since.

CASE 27.—M. E., a woman aged 63, was admitted on June 3, 1930, complaining that she had felt pain in the left eye for the past few months. Three years earlier a cataract had been extracted from the left eye at another hospital. The vision in that eye had gradually become poorer.

Examination of the right eye disclosed early lens opacities; the vision was 16/50—2. The cornea of the left eye was hazy, there was a central leukoma, the iris was atrophic, and there was a thick secondary cataract. In the left eye there was perception of light only. The tension in the right eye was 22 and that in the

left 43. Discission of the membrane in the left eye was done, and the patient was discharged on June 22 with the tension in each eye normal. She has not been seen since.

CASE 28.—J. G., a man aged 58, was admitted in July 1934 with the history of having had a cataract extracted from his right eye in 1922. This operation was followed some time afterward by "hardening of the right eyeball" and complete blindness of the eye. Since then the eye had been painful at intervals. There was no perception of light in the right eye; the vision in the left eye was 16/70 with correction. Examination of the right eye disclosed an acutely congested, stony-hard globe, a thickened cornea and marked edema of the cornea, which prevented intra-ocular examination. The right eye was enucleated.

CASE 29.—M. J., a woman aged 66, was admitted on Dec. 6, 1924, with a history of having had a cataract extracted from her right eye in June 1923 at another hospital. Her chief complaint was of poor vision in the left eye. Examination of the right eye disclosed clouding of the cornea due to keratitis of long standing, a surgical coloboma of the iris and incarceration of the temporal pillar of the iris. The vision was 20/200, and the tension was normal. Examination of the left eye disclosed a mature senile cataract. There was perception of light only. The tension was normal. Preliminary iridectomy was performed in the left eye on December 16, and the cataract was extracted by the extracapsular route on Jan. 2, 1925. The recovery was uneventful.

In May 1925 the patient was readmitted complaining that there had been pain in the right eye for the past three weeks. The tension in the right eye was 40 and that in the left 20. On May 28 corneoscleral trephining was done in the right eye, and on June 5 the patient was discharged with the tension in each eye normal. She has not been heard from since.

CASE 30.—M. J., a woman aged 60, was admitted in October 1926 with the history of having had a cataract extracted from each eye about fourteen years before at another hospital. For the past eight weeks the left eye had been painful. The vision in the right eye was 16/30; in the left eye there was perception of light only. Examination disclosed the operative site and the anterior chamber of the left eye clear, with no abnormalities apparent. There was neither corneal cloudiness nor circumcorneal injection.

Trephining of the left eye was done, and the patient was discharged ten days later with the tension in each eye normal. She did not return for follow-up examination.

CASE 31.—F. M., a man aged 57, had a cataract extracted from his left eye six years earlier at another hospital. He was hospitalized again on Nov. 29, 1930, with a history of having been struck on the right side of his head and right side about ten days before. He complained of slight pain in his left eye. There was no perception of light in the right eye. The left eye showed perception of light with good projection. Further examination disclosed quiescent iridocyclitis of long standing and a complicated cataract in the right eye. There was a secondary cataract in the left eye. The tension in the right eye was 22 and that in the left 60. Wheeler's discission was done in the left eye on December 24, and the tension in this eye subsided. On discharge the tension in each eye was normal and he could count fingers at 1 foot with the left eye. He has not been seen since.

The accompanying table summarizes the foregoing information. Under the column headed Probable Causes the one deemed most important is placed first.

Summary of Postoperative Cases of Glaucoma

Case	Type of Operation	Time of Post-operative Onset	Probable Cause	Treatment	Result
			After Extraction of Cataract		
1	Combined extra-capsular extraction	3 months	Capsular tags in wound	Miotics administered	Condition improved
2	Two-stage extracapsular extraction	9 weeks	Thick secondary membrane	Miotics administered	Condition improved; vision, 16/100+1
3	Two-stage extracapsular extraction	9 days	Atropine	Use of atropine stopped	Condition improved; vision, 16/100
4	Two-stage extracapsular extraction	4 days	Thick secondary membrane, posterior synechiae, infection	Discission, cyclodialysis	Enucleation
5	Two-stage extracapsular extraction	3 months	Lens material in anterior chamber, thick secondary membrane	Paracentesis, Ziegler's discission	Condition improved; perception of light
6	Combined extracapsular extraction	4 months	Incarcerated iris	Discission, iridectomy	Condition improved; vision, 16/40
7	Two stage extracapsular extraction	2 months	Thick secondary membrane, posterior synechiae	Ziegler's discission	Glaucoma cured; vision, 16/20
8	Combined extracapsular extraction	10 days	Trauma, lens material in anterior chamber, prolapsed iris	Iridectomy, use of miotics	Tension still up; vision, 16/30—2
9	Combined extracapsular extraction	1 month	Loss of vitreous, secondary membrane	Discission	Condition improved
10	Combined extracapsular extraction	1 week	Capsular tags in wound, prolapsed iris	Capsulectomy discission, anterior sclerectomy	Tension still up; vision, hand movements at 1 foot
11	Two-stage extracapsular extraction	2 weeks	Lens material in anterior chamber	Use of miotics, trephination	Glaucoma cured; vision, 16/30
12	Two-stage extracapsular extraction	4 months	Incarcerated iris	Cyclodialysis, freeing of iris pillar	Glaucoma cured; perception of light
13	Two-stage extracapsular extraction	22 months	Incarcerated iris	Trephination	Condition improved
14	Two-stage extracapsular extraction	13 months	Previous glaucoma	Trephination	Condition improved; vision, 16/100
			After Discissions		
15	Ziegler's discission	1 month	Capsular tags in wound, vitreous in anterior chamber	Cyclodialysis, anterior sclerectomy, modified Lagrange operation, iridectomy, administration of miotics	Glaucoma cured; fingers counted at 1 foot

Summary of Postoperative Cases of Glaucoma—Continued

Case	Type of Operation	Time of Post-operative Onset	Probable Cause	Treatment	Result
16	Ziegler's discission	1 month	Incarcerated iris, anterior synechia	Wheeler's discission, paracentesis, administration of miotics	Tension still up; perception of light
17	Iridectomy and de Wecker's discission	2 weeks	Vitreous in anterior chamber	Administration of miotics	Tension still up; vision, 16/40
18	Wheeler's discission	1 month	Vitreous in anterior chamber, thick secondary membrane	Trephination	Condition improved
19	de Wecker's discission	1 month	Thick secondary membrane	Trephination	Condition improved
20	Wheeler's discission	2 weeks	Lens material in anterior chamber	Administration of miotics	Glaucoma cured
21	Wheeler's discission	2 weeks	Thick secondary membrane	Administration of miotics	Glaucoma cured
22	Wheeler's discission	2 days	Thick secondary membrane	Paracentesis, discission, Wheeler's discission, trephination, iridotasis	Condition improved; perception of light
23	Wheeler's discission	2 days	Lens material in anterior chamber, loss of vitreous	Use of miotics	Glaucoma cured; vision, 16/15
24	Wheeler's discission	5 days	Vitreous in anterior chamber	Use of miotics	Glaucoma cured; vision, 16/30
			Admissions from Other Hospitals		
25	Two-stage intracapsular extraction	3 months	Acute iritis	Trephination	Condition improved; fingers counted at 1 foot
26	Two-stage intracapsular extraction	4 months	Retinal hemorrhage?	Trephination	Condition improved; vision, 3/200
27	Two-stage intracapsular extraction	"Several months"	Thick secondary membrane	Discission	Condition improved; perception of light
28	Two-stage intracapsular extraction	"Some time after"	?	Enucleation	Anophthalmos
29	Combined extracapsular extraction	2 years	Incarcerated iris	Trephination	Condition improved; perception of light
30	Two-stage extracapsular extraction	14 years	?	Trephination	Condition improved; perception of light
31	Two-stage extracapsular extraction	6 years	Trauma, thick secondary membrane	Discission	Condition improved; fingers counted at 1 foot

COMMENT

Incidence.—Our series of 24 cases represents an incidence of postoperative glaucoma of approximately 1.5 per cent. Of these cases, 14 occurred in the course of 1,182 cataract extractions, i. e., following 1.2 per cent, and 10 in the course of 447 discissions, i. e., following 2.2 per cent. Twenty-three patients are represented here (1 had bilateral involvement); 9 of these were females and 14 were males. The youngest was 47 years of age and the oldest 79. The average age was 61.8 years. It will be noted that the incidence of glaucoma following discission is almost twice that of glaucoma following extraction of cataract. On the whole these figures agree quite closely with those of Knapp, Pinto and others.

Etiology.—The causes of glaucoma in our series may be summarized as follows (subsidiary causes not included):

Thick secondary cataract	6
Lens material in anterior chamber	4
Vitreous in anterior chamber	4
Incarcerated iris	4
Capsular tags in wound	3
Previous glaucoma	1
Atropine	1
Trauma to head	1

It will be noted that this list coincides substantially with the causes for postoperative glaucoma found by other observers cited in this report. In almost every case the precipitating factor has been found to be mechanical obstruction at the filtration angle.

All the extractions involved here were extracapsular. During the period covered by this study intracapsular extractions were done but rarely, hence we have no information of our own as to the relative rôles played by the intracapsular and the extracapsular method in the etiology of postoperative glaucoma. With one outstanding exception there is little reference in the literature to this phase of the subject. A. Knapp[47] makes no mention of postoperative glaucoma in his first three reports covering 300 intracapsular extractions. In his fourth report, covering 100 intracapsular extractions, however, he describes 4 such cases.[48] In an article[49] dealing with some of the late results of

47. Knapp, A.: Arch. Ophth. **44**:1 (Jan.) 1915; **50**:426 (Sept.) 1921; Extraction of Cataract: Report of Third Hundred Successive Extractions in Capsule After Preliminary Subluxation with Capsule Forceps, ibid. **5**:575 (April) 1931.

48. Knapp, A.: Intracapsular Operation for Cataract: Report on Fourth Hundred Successive Extractions, Arch. Ophth. **10**:6 (July) 1933.

49. Knapp, A.: Arch. Ophth. **55**:257 (May) 1926.

intracapsular extractions he reports another case occurring in one of the earlier series which he found six years after operation. Thus he has 5 cases in a series of 400 intracapsular extractions, an incidence of about 1.2 per cent—corresponding exactly to our percentage for extracapsular extractions. He remarked in this connection that glaucoma is one of the most serious of the postoperative complications. It is of interest to note that of 3 patients having previous glaucoma to whom he referred 2 were cured of the hypertension; in the other the condition persisted and required a secondary operation.

In considering the intracapsular versus the extracapsular method one cannot help but be struck by the much more frequent reports of loss of vitreous as a complication of the former. This is true of the Barraquer method [50] especially, as well as of the others. Since this complication, as indicated in the foregoing tabulation, is one of the more important causes of postoperative increase in tension, one can but wonder what its incidence would be if the intracapsular extractions were followed up for a greater length of time. Also, one must not forget that complications such as incarceration of iris, retinal detachment, rupture of the hyaloid membrane, iritis and iridocyclitis occur in intracapsular as well as in extracapsular extractions. One postoperative complication, however, is avoided to a large extent: Parker [51] in a review of 450 cataract extractions—including 150 each of combined extracapsular, simple extracapsular and Knapp-Török intracapsular extractions—found the incidence of secondary cataract to be 22.7, 32 and 5.3 per cent, respectively. Since glaucoma following discission is even more frequent than that following cataract extraction it must be admitted that indirectly the successful intracapsular extraction, in obviating a secondary cataract, does away with one of the most common sources of postoperative glaucoma. Per se, however, there is no evidence as yet that the intracapsular extraction shows a lesser incidence of glaucoma. Indeed, what statistics there are show this condition occurring with the same frequency after both methods.

We are now doing intracapsular extractions frequently, and a later comparative study might be valuable in this respect.

Of our 10 cases of glaucoma following discission only 2 followed Ziegler's operation. But since the ratio of the Wheeler to the Ziegler discissions done over this period was about 4 to 1 the type of discission seems to have no bearing on the etiology of the glaucoma.

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50. de Almeida, G.: Brasil-med. **1**:15 (Jan.) 1923. Troncoso, U.: Ann. d'ocul. **126**:401, 1901. Barraquer, I.: Bull. et mém. Soc. franç. d'opht. **45**:179, 1932.

51. Parker, W. R.: Comparative Results in Extraction of Senile Cataracts Using Combined, Simple and Knapp-Török Intracapsular Methods, Arch. Ophth. **11**:183 (Jan.) 1934.

In our cases the time of onset varied from two days to twenty-two months after operation, and in 16 of the 24 cases the onset occurred within one month or less. The patients coming to Bellevue Hospital from other hospitals are of interest because 3 of them (29, 30 and 31) represent longer lapses of time between operation and the onset of the glaucoma than any of our own. One (30) gave a history of onset fourteen years after operation with no apparent cause, and the glaucoma might well fit into Natanson's primary postoperative group if one were to accept a few isolated cases as indicative of a type. On the other hand, cases 29 and 31 occurred two and six years after operation, respectively, but definite obstructive causes were ascertainable.

Prophylaxis.—Since its recognition as a clinical entity numerous suggestions have been offered for the prevention of postoperative glaucoma. Among these are the following:

1. Care not to lose vitreous [2]
2. Preliminary iridectomy [3]
3. Wide dilation of the pupil to facilitate evacuation of all cortical material [52]
4. Simplest possible operation [8]
5. Avoidance of deep discission [10]
6. Simple extraction with a small peripheral opening [10]
7. Preoperative use of physostigmine and morphine and postoperative use of pilocarpine [10]
8. Sclerocorneal section to prevent epithelial proliferation in incision [53]
9. Intracapsular extraction, because no discission is required [54]
10. Taking tensions frequently, not doing discission too soon and avoidance of use of atropine [44]

In other words, any procedure which makes for a clear anterior chamber, an unobstructed filtration angle and quick healing of a clean wound is the procedure of choice if postoperative glaucoma is to be avoided. And in view of our findings this seems to be the logical conclusion.

As an extra precaution and to guard against a flare-up in a quiescent eye suffering from glaucoma simplex—a possibility pointed out by Hardy [38]—I have adopted, at the suggestion of Dr. W. W. Weeks, the practice of including in the preoperative work-up perimetric studies of the visual fields, studies of the light fields if necessary, and taking of tensions morning, noon and night for several successive days. This procedure usually brings out early nasal defects and minor cyclic changes in tension which would otherwise be missed.

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52. Risley.[16] Knapp.[40]
53. Chance.[29] Knapp.[40]
54. Fage.[39] Wolfe.[44]

Therapeusis.—The literature is replete with suggestions of operations and procedures for the cure of postoperative glaucoma, of which I list a few:

1. Iridectomy with use of hook [10]
2. Sclerectomy and evacuation of vitreous [17]
3. Section of adherent capsular remnants when present [22]
4. Trephination below where iris is present [34]
5. Basal iridectomy [55]
6. Iridectomy or cyclodialysis [55]
7. Intramuscular injection of ergotamine tartrate [56]

In our hands no single procedure proved of special benefit. In case 3 the glaucoma subsided promptly on cessation of the administration of atropine. In case 23, in which the best result was obtained, only miotics and hot compresses were used. We found no one operation of unique value, though the corneoscleral trephination was accompanied with fair success. From our experience we can offer no "sure cure" for postoperative glaucoma.

Prognosis.—As may be seen from the table, the prognosis for ultimate useful vision is poor. Our results show that only 10 of the 31 patients (about 32 per cent) retained a vision of 16/100 or better when last seen. Of our 24 patients, only 8 (33 per cent) showed "cures" as far as apparent permanent lowering of tension was concerned; 4 of these retained good vision, 2 had only perception of light, and in 2 the final vision was not ascertained. In the 11 patients whose condition was "improved" the improvement probably represented more hope than realization. These were patients whose tension was approximately normal when they were last seen but who could not be followed up. Unfortunately, the type of patient handled at Bellevue Hospital makes prolonged follow-up difficult. Judging by those whom we were able to follow up closely over a reasonable period, a goodly proportion of the patients whose condition was "improved" would have a recurrence of their glaucoma with consequent further decrease in vision. Nor are our so-called "cured" patients immune from this possibility.

Of the remaining 5 patients, 4 still showed increased tension when last seen and 1 required enucleation of an eye. As stated, the prognosis is not good.

SUMMARY

The evidence of the literature and our own findings overwhelmingly points to obstruction at the filtration angle as the ultimate cause of all postoperative glaucoma.

55. Knapp.[10] Knapp.[11]

56. Gifford, S. R.: A Hand-Book of Ocular Therapeutics, Philadelphia, Lea & Febiger, 1932, p. 201.

The division into primary and secondary glaucoma is arbitrary. Postoperative glaucoma in the vast majority of cases is secondary to operative procedure irrespective of the time elapsed.

A review of 856 cases of cataract observed at Bellevue Hospital between January 1923 and November 1934 is given. Of the 1,629 operations for cataract, 1,182 were extractions and 447 were discissions. In 24, or 1.5 per cent, of the cases of cataract, postoperative glaucoma developed. Of these, 14, or 1.2 per cent, followed extracapsular extractions of cataract and 10, or 2.2 per cent, followed discissions. The type of discission done seems to have had no bearing on the incidence of glaucoma. Our percental incidence is approximately the same as that found by most other writers.

The prevention of postoperative glaucoma depends on a scrupulously clean anterior chamber after operation and a careful toilet of the wound.

No single procedure of outstanding value for the cure of postoperative glaucoma was found.

The prognosis for ultimate useful vision once postoperative glaucoma has developed is poor.

OPHTHALMOLOGIST, OCULIST, OPTICIAN AND OPTOMETRIST

THE ORIGIN OF THESE WORDS IN THE ENGLISH LANGUAGE

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Twenty-two medical specialties are listed in the "American Medical Directory" for 1934. The name of one specialty, "public health," is a combination of an Anglo-Saxon word and an adaptation[1] of a word from the Latin word *populus* (people). "Medicine" and "obstetrics" are adaptations of Latin words. "Tuberculosis" is derived from a Latin word with the addition of the suffix *-osis,* representing the Greek -ωσις. The names of the other eighteen specialties ("roentgenology" and "radiology" are here included) are derived from Greek words.

The medical specialty devoted to the diseases of the eye is listed as "ophthalmology." The physician specializing in the diseases of the eye is known as an "ophthalmologist," a term which is formed on the Greek word ὀφθαλμός (eye) plus λόγος (a word). He is also known as an "oculist," a term which is an adaptation of the Latin word *oculus* (eye). The physician specializing in diseases of the eye is the only one of the medical specialists who has two different terms to designate him as a specialist; all other specialists have only one term. This is unfortunate, for not only are the words "ophthalmologist" and "oculist" confusing to medical men, but many medical men and many laymen confuse these terms with the words "optician" and "optometrist."

The different words that are formed on *ophthalmo,* such as "ophthalmologist" and "ophthalmia," are derived from the Greek word ὀφθαλμός (eye). From the Latin word *oculus* (eye) are derived such words as "oculist" and "oculomotor." From the Greek word ὀπτικ-ός, meaning "pertaining to sight," from the root ὀπ (eye) are derived such words as "optics" and "optometrist." As will be shown, these words entered the English language not as direct adaptations from Greek and Latin but indirectly through French and late and medieval Latin.

From the Division of Ophthalmology, Stanford University Medical School.

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1. According to the "Oxford English Dictionary," a word derived from a foreign language may be adopted without change of form (or pronunciation) from the foreign word, may be derived by adaptation, that is, with adjustment to English speech habits, or may be formed on, that is, newly shaped on the basis of, the foreign word.

In this paper I shall trace and discuss the origin of the words in the English language based on the Greek words ὀφθαλμός and ὀπτικ-ός and the Latin word *oculus*. I shall propose that only the word "ophthalmologist" be used in the medical and scientific literature to refer to a physician specializing in the diseases of the eye. I shall also propose that in the lay press the term "eye physician" instead of "eye specialist" be used when one is designating a physician specializing in the diseases of the eye.

ὀφθαλμός (EYE)

The first written record in English of a word formed on the Greek word ὀφθαλμός is the word "ophthalmia," which appeared in 1398. "Ophthalmia" was not directly derived from the Greek but was taken indirectly from the late Latin word *ophthalmia,* which was borrowed from the Greek word ὀφθαλμία, formed on the Greek word ὀφθαλμός. It was spelled first "obtalmia," in the fifteenth century "obtolmia" and in the sixteenth century "optalmia" and "ophtalmia." Later it was spelled "ophthalmia."

"Ophthalmia" was originally used in the same sense as it is today. It was first used in 1398 by John de Trevisa in his book entitled "De Glanvilla Bartholomeus de proprietatibus rerum." In the edition published in 1495 (book 7, chapter 16, page 235) it appeared as follows: "A rewme rennyth to the eyen, and thereof comyth an euyll that highte Obtalmia, a shrewde blerinesse and ache." About 1400 it appeared in Lanfrank's "Science of Cirurgie" (page 241) as follows: "Othere maner sijknes of the iye . . . as obtolmia & blere iyed." In 1541 Robert Copland wrote in his work entitled "The Questyonary of Cyrurgyens, with the Formulary of Lytell Guydo in Cyrurgie, with the Spectacles of Cyrurgyens Newly Added, with the Fourth Boke of Terapeutyke, or Methode Curatyfe of Claude Galyen:" "Thyrdly is admynystred colirium de thutia . . . in the ende of optalmia." In 1562 William Bullein wrote in his work entitled "Bulwarke of Defence Against All Sicknesse, Soarenesse and Woundes; the Booke of Simples, Dialogue Betweene Sorenes and Chirurgi, The Boke of Compoundes, The Booke of the Vse of Sicke Men and Medicines" (page 2): "Ophthalmia . . . is a sicknes of the eye." In 1597 Peter Lowe in his work entitled "The Whole Course of Chirurgerie" (1634 edition, page 155) stated: "Ophthalmia . . . is an inflammation of the whole eye, but chiefly of the membraine called conjunctiue."

Used in the same sense as "ophthalmia" was the word "ophthalmy," an adaptation of the French word *ophtalmie,* which was an adaptation of the Latin word *ophthalmia.* It was first spelled "optalmie" and "ophthalmye;" in the seventeenth century "ophthalmie," and later, "ophthalmy." The word is now obsolete. In 1543 Bartholomew Tra-

heron in his translation of the work entitled "The Most Excellent Workes of Chirurgerye Made by J. Vigon" (page 51) spoke of "an optalmie caused of grosse matter." Vigon was physician to Pope Julius II. The translation of Jacques Guillemeau's work, "French Chirurgerye or the Manualle Operations of Chirurgerye," by a translator who signed himself "A. M." and published in 1597, contained a reference (page 32) to "payne in the heade . . . ophthalmye and payne in the teeth." Jacques Guillemeau wrote the best of the Renaissance books on ophthalmology, "Traite des maladies de l'œil," which was tranlated into English by Richard Banister in 1662. In 1650 John Trapp in his work entitled "A Commentary to Deuteronomy" (chapter 28, page 28) said: "God, we trust, will . . . cure them of this spiritual ophthalmy and phrensie."

"Ophthalmic," an adaptation of the Latin word *ophthalmicus,* adopted from the Greek word ὀφθαλμικ-ός (of or pertaining to the eye) first appeared as an adjective in Thomas Timme's 1605 translation of the work of J. Du Chesne's (Quersitanus) entitled "Practise of Chymicall and Hermeticall Physicke" (book 3, page 155) as follows: "an excellent ophthalmick matter for the eyes." In 1725 Richard Bradley in his translation of Chomel's book entitled "Dictionaire Œconomique, or the Family Dictionary," mentioned "*Eye-water,* A Choice Ophthalmick Water to preserve the Eyes and Sight."

"Ophthalmic" was used as a noun in 1653 by Nicholas Culpepper in his "Pharmacopœia Londinensis; or, the London Dispensatory Further Advanced by the Studies and Collections of the Fellows Now Living of the Said Colledg" (book 5, page 306), in which he said, "Such Medicines as are appropriated to the Eyes . . . I would have called them Ophthalmics had not the word been troublesom to the reading." Almost three hundred years later one may still say that the word "ophthalmic" is still troublesome to many readers. In 1693 Sir Thomas P. Blount said in his work entitled "A Natural History, Containing Many Not Common Observations, Extracted Out of the Best Modern Writers" (page 292), "The Liquor of Ants is commended by Schroder for a most Excellent Ophthalmick."

"Ophthalmist" (rare) for "ophthalmologist" was used by John Edwards in 1696 in his book entitled "A Demonstration of the Existence and Providence of God, From the Contemplation of the Visible Structure of the Greater and Lesser World" (book 2, page 33) as follows: "The fourth and last Membrane . . . though some Ophthalmists have talke'd of a Fifth . . . is the Retina."

"Ophthalmoscopy" was first used in a different sense than it is used today. It referred to that branch of physiognomy by which character is inferred from the appearance of the eyes. In Ephraim Chambers'

"Cyclopœdia; or, an Universal Dictionary of Arts and Sciences," 1727 to 1741, "ophthalmoscopia" is defined as "that branch of physiognomy which considers a person's eyes, and looks; to deduce thence the knowledge of his temperament, humour, and manners."

"Ophthalmoscopy," used in the modern sense, appeared soon after the invention of the ophthalmoscope by Helmholtz in 1851. The "New Sydenham Society Year-Book of Medicine" (page 240), published in 1864, contained an "atlas of ophthalmoscopy."

"Ophthalmiater," in the sense of "ophthalmologist," was used by the famous quack ophthalmologist John Taylor, who achieved considerable notoriety and was appointed oculist to King George II. In 1761 appeared a work entitled "Adventures of Chevalier John Taylor, written by himself, The Chevalier John Taylor, Ophthalmiater, Pontificial, Imperial, and Royal, who treated Pope Benedict XIV, August III, King of Poland, Frederick V, King of Denmark and Norway and Frederick Adolphus, King of Sweden."

"Ophthalmologist" first appeared in 1834 in John Mason Good's work on "The Study of Medicine" (edition 4, volume 3, page 166) as follows: "No ophthalmologist . . . has paid as much attention to this subject as Professor Beer."

"Ophthalmological" first appeared in the work by Robert B. Todd entitled "The Cyclopœdia of Anatomy and Physiology," 1839 to 1847 (volume 3, page 85), as follows: "in their ophthalmological works."

"Ophthalmologic" used as an adjective appeared in 1846 in Joseph E. Worcester's work, "A Universal and Critical Dictionary of the English Language."

"Ophthalmology" appeared in 1842 in Robley Dunglison's "Medical Lexicon: A Dictionary of Medical Science."

The ophthalmoscope was not invented until 1851, and the word "ophthalmoscope" first appeared in English in 1853 in an article by T. Spencer Wells in the *Medical Times and Gazette* (volume 7, page 264) entitled "Some Account of a New Ophthalmoscope." It is interesting to note that the first description in English of Helmholtz' ophthalmoscope was published in 1852, one year after its invention, by W. R. Sanders in the *Monthly Journal of Medical Science* (volume 15, page 40) in an article entitled "On Helmholtz's Speculum for Examining the Retina in the Living Eye," which is a literal translation of the title which Helmholtz gave to his original paper, "Beschreibung eines Augen-Spiegels zur Untersuchung der Netzhaut im lebenden Auge."

In 1854 Thomas Wharton Jones published in the *British and Foreign Medico-Chirurgical Review* (volume 14, page 426) his "Report on the Ophthalmoscope," wherein he told the story of how he rejected the first

ophthalmoscope, which was invented by the English mathematician Charles Babbage and was submitted to him for approval. Jones wrote:

> Dr. Helmholtz, of Königsberg, has the merit of specially inventing the ophthalmoscope. It is but justice that I should here state, however, that seven years ago Mr. Babbage showed me the model of an instrument which he had contrived for the purpose of looking into the interior of the eye. It consisted of a bit of plain mirror, with the silvering scraped off at two or three small spots in the middle, fixed within a tube at such an angle that the rays of light, falling on it through an opening in the side of the tube, were reflected into the eye to be observed, and to which the one end of the tube was directed. The observer looked through the clear spots of the mirror from the other end.

OCULUS (EYE)

The first record of the use of the word *oculus* was to describe two plants called oculus Christi (Christ's eye), a medieval Latin name for (*a*) wild clary, or sage, Salvia verbenaca, and (*b*) a composite plant, Inula oculus-Christi. The "Promptorium parvulorum sive clericorum: Lexicon Anglo-Latinum princeps" (page 361) published in about 1440 refers to "Oculus Christi, herbe, *hispia.*" John Gerard in his work, "The Herball, or General Historie of Plants" (book 2, part 255, page 628), published in 1597, said: "Wilde Clarie is called after the Latine name Oculus Christi, of his effect in helping the diseases of the eies." In 1658 Edward Phillips in his work entitled "The New World of English Words; or, A General Dictionary," referred to "*Oculus Christi,* a certain herb very good for the eyes, otherwise called wild clary."

There is no record until 1549 of the use of any word referring to the eye formed on the Latin word *oculus.* This is one hundred and fifty years after the appearance of the word "ophthalmia," the first recorded word formed on the Greek word for eye. It first appeared as "oculate" (now obsolete), an adaptation of the Latin word *oculatus* (possessed of eyes), formed on the word *oculus* (adjective), used in the sense of "furnished with or possessed of eyes or sight; sharp-sighted, observant." In 1549 E. Becke in his "Dedication to Matthew's Bible" said: "He that walketh without this lanterne . . . be he neuer so oculate . . . yet he is but blynd." In 1615 Helkiah Crooke in his work entitled "A Description of the Body of Man" (page 221) said: "It cannot be perceiued vnlesse the Anatomist be very diligent and occulate." In 1657 Richard Tomlinson in J. Renodœus' "Medicinal Dispensatory" (page 277) mentioned "an oculate faithfull Narrator."

"Oculate," as a term used in natural history to mean "having eye-like spots or holes resembling eyes," was used in 1656 by Thomas Blount in his work entitled "Glossographia, or a Dictionary Interpreting Such Hard Words . . . as Are Now Used" as follows: "Oculate, full

of eyes or holes." In 1661 Robert Lovell in his work entitled "A Compleat History of Animals and Minerals" said: "Isagoge, Raie undulate and oculate . . . stellarie oculate and clavate."

There was a single instance of the use of "oculate" as a verb, meaning "to set eyes upon; to see; to behold" in 1609 in "Everie Woman in Her Humor" (book 5, chapter 1), published in "A Collection of Old English Plays" (volume 4) by Arthur H. Bullen, which appeared as follows: "Diana bathing herself, being discovered or occulated by Acteon."

"Ocular," also spelled in the sixteenth and seventeenth centuries as "occular" and "occulare" (adjective and noun), meaning "belonging to or connected with the eye as a bodily organ," appeared in the translation of Jacques Guillemeau's work, "French Chirurgerye or the Manualle Operations of Chirurgerye," by a translator who signed himself "A. M." and published in 1597 as follows: "the Eye, or ocullare vayne" (page 12). In O. Gabelhouer's "Boock of Physicke," translated by "A. M." in 1599, the author mentioned "a tryede Oculare vnguent" (page 53). In 1661 Robert Lovell in his work entitled "A Compleat History of Animals and Minerals (page 83) mentioned "it's used in ocular remedies."

"Ocular," meaning "ocular inspection," was used in about 1575 by Sir James Balfour in his "Practicks; or A System of the More Ancient Law of Scotland" (1754 edition, page 382) as follows: "The Lordis of counsal, be ocular inspectioun, may decern . . . ony letter, contract . . . or uther writ, to be false and feinziet."

"Ocular" (rare), meaning "obtained by the use of the eye or derived from what is actually seen, as ocular inspection," was used in 1608 by Thomas Dekker in his work entitled "The Dead Tearme" (chapter 4) as follows: "to bee an Occuler witnesse-bearer of what I speake." In 1650 John Bulwer in his "Anthropometamorphosis; Man Transformed, or the Artificial Changeling, Etc." (page 93) used the word in the following passage: "which will appeare more credible by the modern relations of some ocular witnesses."

"Ocular," meaning "addressed to the eye; visible; conveyed to the mind through the actual sight of a thing," was used in 1589 by George Puttenham in his work entitled "The Arte of English Poesie" (Arber's reprints; book 2, part 10, page 98) as follows: "Your occular proportion doeth declare the nature of the audible: for if it please the eare well, the same represented by delineation to the view pleaseth the eye well."

Shakespeare used the words "eye" and "eyes" 1,025 times (including the word "eyed," 4 times) in his dramatic works and 241 times (including the word "eyed" once) in his poems; the word "eyne" (archaic English plural for the word "eye," used mostly for the sake of the

rhyme) 9 times in his dramatic works and 4 times in his poems; the words combined with the word "eye" (such words as "eyelid" and "eyesight") 46 times in his dramatic works and 6 times in his poems; a total of 1,331 times. However, he did not use any word derived from the Greek word for eye, and he used only once a word derived from the Latin word *oculus* (occular, in 1604).

When Iago accused Desdemona of being unfaithful to Othello, Othello cried out:

> Villaine, be sure thou proue my Loue a Whore;
> Be sure of it: Giue me the Occular proofe,
> Or by the worth of mine eternall Soule,
> Thou had'st bin better haue been borne a Dog
> Then answer my wak'd wrath.

"The Tragedie of Othello, The Moore of Venice," act III, scene 3, lines 415 to 419 (the new Variorum edition of Shakespeare, edited by Furness, 1886).

In 1615 George Chapman in his translation of the "Odyssey" (book 23, page 349) said, "The scar That still remaines a marke too ocular To leaue your heart yet blinded."

"Ocular," meaning "expressed by the eye," was used in 1627 by John Donne in his "Sermons" (volume 5, page 48) as follows: "They did countenance that which was said with . . . ocular applause with fixing their eyes upon the Preacher."

"Ocular," meaning "of the nature, form or function of an eye," was used in 1640 by William Somner in "The Antiquities of Canterbury" (page 171) as follows: "the ocular and peeked or pointed form of the arch." In 1659 Daniel Pell in his work entitled "Nec inter vivos, nec inter mortuos; or, an Improvement of the Sea" (page 195) mentioned "the excellency of that ocular Organ that God hath bestowed upon man."

"Ocular" (obsolete), meaning "ocular quality or property," was used in 1656 by "S. H." in "The Golden Law" (page 70) as follows: "Its Natures, and not Names; its occults, and not occulars, entitle to the title King."

"Ocularily" (obsolete) was used as an adverb in 1629 by George Chapman in his translation of Juvenal's fifth satire as follows: "ocularily to present you with example of what I esteem fit."

"Oculary" (rare) was used like the modern term "ocular" in 1600 by W. Vaughan in his "Golden Groue" (1608 edition, volume 1, book 5) as follows "heynous, literall, oculary vntrueths." In 1601 Philemon Holland in "Pliny's Historie of the World, Commonly Called the Natural Historie" (volume 2, page 272) referred to "eie-salues, and other ocularie medicines."

"Ocularly," meaning "to the eyes or sight; visible," was used in 1628 by Thomas Jackson in his "Commentaries Upon the Apostles Creed"

(book 9, chapter 3, paragraph 1) as follows: "The other passages in the same psalm were ocularly exemplified and fulfilled in Him." In 1664 Henry Power in his "Experimental Philosophy" (book 1, page 58) said, "It is ocularly manifest."

"Ocularly," meaning "with or by means of one's eyes or sight," was used in 1646 by Sir Thomas Browne in his "Pseudodoxia Epidemica, or Enquiries Into Very Many Received Tenents" (book 7, part 15, page 369) as follows: "Andrew Thevet in his Cosmography doth ocularly overthrow it; for hee affirmeth, he saw an Asse with his saddle cast therein, and drowned." The 1660 translation of Paracelsus' "Archidoxes" (book 1, part 1, page 5) contains the following sentence: "Wee are made certain, and do occularly behold that the thing is truly so."

"Oculation" (rare), meaning "inoculation," used as a noun of action (from the Latin word *oculare*—"to furnish with eyes," after *oculus*) in the sense of "eye or bud" of a plant, was used in 1611 by John Florio in his "Queen Anna's New World of Words" as follows: "*Innestare ad occhio,* to inoculate, to graffe by way of oculation."

"Oculist," when first used in English, was not derived directly from the Latin word *oculus* but was an adaptation of the French word *oculiste* (which was used by Ambroïse Paré in the sixteenth century), which was formed on the Latin word *oculus* plus the suffix *-ist*. It was first used in the same sense as today. The word first appeared in 1615 in Helkiah Crooke's work entitled "A Description of the Body of Man" (page 538) as follows: "those whom we call Oculists, that is, such as professe and intend the cure of the eies." In 1630 Richard Brathwait in "The English Gentleman" (1641 edition, page 197) said: "It is observed by profest Oculists, that whereas all creatures have but foure muscles to turne their eyes round about, man hath a fift to pull his eyes up to heaven." In 1711 Joseph Addison in *The Spectator* (number 124, paragraph 6) spoke of "Having consulted many Oculists for the bettering of his Sight." In 1866 Miss Mary E. Braddon in "The Lady's Mile" (chapter 28, page 313) said: "I must go at once to an oculist."

"Oculist" (obsolete) meaning "one who has good eyes, or uses them well," was used in 1660 by Richard Burney in his work entitled "King Charles the Second . . . *Presented to the Houses of Parliament, Etc. (Sermons)*" (1661 edition, page 6) as follows: "a sacred Oculist that could see to the end of a storm."

ὀπτικ-ός (PERTAINING TO SIGHT)

"Optic" was first used in 1541. It was first spelled "obtyke;" in the sixteenth and seventeenth centuries it was spelled "obtick," "opticke," "optike" and "optique;" in the seventeenth and eighteenth centuries "optique" and "optick," and later, "optic." In 1656 Thomas Blount in

his "Glossographia, or a Dictionary Interpreting Such Hard Words . . . as Are Now Used" said, "To the reader: There is a liberty in most Adjectives, whether you will say *Optique* (after the French), Optick, Opticous, or Optical." "Optic" is derived from the French word *optique,* an adaptation of the medieval Latin word *opticus,* which was an adoption of the Greek word ὀπτικ-ός (of or pertaining to sight).

"Optic" was first used as an adjective in the anatomic sense, meaning "pertaining to or connected with the eyes," in 1541 by Robert Copland in his work entitled "The Questyonary of Cyrurgyens, with the Formulary of Lytell Guydo in Cyrurgie, with the Spectacles of Cyrurgyens Newly Added, with the Fourth Boke of the Terapeutyke, or Methode Curatyfe of Claude Galyen" (chapter 3) as follows: "Wherefore are the synewes obtykes perced? Answere. For to be the waye of the spryte vysyble." In 1543 Bartholomew Traheron in his translation of the work entitled "The Most Excellent Workes of Chirurgerye Made by J. Vigon" (book 1, chapter 2, page 3) used the word as follows: "that they might receave the visible spirite by the synnowe called Optique." In 1615 Helkiah Crooke in his work entitled "A Description of the Body of Man" (page 530) said "The Opticke Nerues stood in neede to bee very short."

"Optic," as an adjective meaning "pertaining to sight; visual," was used in 1599 by Ben Jonson in "the Comicall Satyre of Every Man Out of His Humor" (book 2, chapter 3) as follows: "Dazle, you organs to my optique sense." In 1616 John Bullokar in his work entitled "An English Expositor" mentioned *"optike,* belonging to the sight."

"Optic" was used as an adjective, meaning "pertaining to or skilled in the science of sight and light" ("optics" in the modern sense) in 1569 by James Sanford in his translation of H. C. Agrippa's work entitled "Of the Vanitie and Uncertaintie of Artes and Sciences" (page 34) as follows: "Nexte after Geometrie, is the Arte Opticke which is called Perspectiue." In 1624 Sir Henry Wotton in his work entitled "The Elements of Architecture" (1672 edition, page 26) said: "We have an Optique Rule, that the higher they (Pillars) are, . . . the less should be alwayes their diminution aloft."

"Optic," meaning "constructed to assist the sight; acting by means of light; optical," was used in 1607 by Thomas Walkington in his work entitled "The Optick Glasse of Humors." In 1611 Thomas Coryat in "Coryat's Crudities; Hastily Gobled up in Five Moneths Travels" said "This Counsellor is like that opticke-glasse wherein not onely the space of three or tenne miles but . . . of the whole world it selfe may be represented." About 1626 Lancelot Andrewes in his "Sermons" (1856 edition, volume 1, page 42) said, "We shall need no prospective glasses, or optic instruments, to make it visible."

"Optic," meaning "of or pertaining to sight in relation to light or to light as the medium of sight;" was used in 1664 by Henry Power in his "Experimental Philosophy" (book 1, page 80) as follows: "Take a fresh Eye . . . cut it with a plain Parallel to the Optick Axis." In 1710 John Clarke in his translation of Jacques Rohault's "System of Natural Philosophy" (1729 edition, volume 1, page 247) said: "We turn our Eyes to it in such a manner, that the two Optick Axes meet at the Point which we fix our Attention principally upon."

"Optic" was used as a noun, chiefly in the plural, meaning "the organ of sight; the eye," in 1620 by Richard Brathwaite in his "Essaies Upon the Five Senses." This appeared in Sir Samuel Egerton Brydges' "Archaica" (1815, volume 2, part 5) as follows: "By that elevating muscle by which it is distinguished from the optic in all other creatures, it [the eye] is taught to be on that subject only fixed, where it may be wholly and solely satisfied." In 1642 James Howell in his "Instructions for Forreine Travell (page 88) said: "Not by hear-say only, or through the mist of other mens breaths, but through the cleere casements of his own optiques. . . ."

"Optic" was used figuratively in about 1650 by Denham in his "Friendship and Single Life Against Love and Marriage" (chapter 2) as follows: "Our corporeal eyes, we find, Dazzle the optics of our mind." It was used figuratively for "visual power" in 1643 by Sir Thomas Browne in his "Religio Medici" (book 1, paragraph 44) as follows: "Nor is it in the Opticks of these eyes to behold felicity."

"Optic" (obsolete) was used as a short term for the "optic nerve" in 1615 by Helkiah Crooke in his work entitled "A Description of the Body of Man" (page 485) as follows: "The first conjugation therefore of the nerues of the braine are the Opticks."

"Optic" (obsolete) was used to mean "optic glass, an eyeglass or lens" in about 1631 by John Donne in his "Poems, to Mr. Tilman" (page 46) as follows: "If then, th' astronomers, whereas they spy A new-found star, their opticks magnify. . . ." In 1640 Thomas Nabbes in "The Bride, A Comedie" (book 4, chapter 1) said, "A . . . stone with an inscription That is not legible but through an optick Tells us its age."

"Optic," meaning "one skilled in optics" (optician), was used in 1636 by Daniel Featley in his book entitled "Clavis Mystica; A Key Opening Divers Texts of Scripture" (chapter 31, page 410) as follows: artificiall pictures drawne by the pencill of a skilful Opticke." In 1656 Peter Heylin in his book entitled "A Full Relation of Two Journeys: The One, Into the Mainland of France; the Other, Into Some of the Adjacent Islands" (page 180) remarked on "A tablet . . . such as would infinitely delight an optick." In 1675 the *Philosophical Transactions of the Royal Society* (volume 10, page 501) contained the follow-

ing statement: "Mr. Newton had no reason to tax P. Pardies of Hallucination. . . . For that learned optike very well saw . . ."

"Optic" (obsolete), meaning "the science of sight or light; optics" was used in 1611 by John Florio in "Queen Anna's New World of Words" as follows: *"ottica,* the science whereby the reason of sight is knowen, the optike." In 1621 Robert Burton in his work entitled "The Anatomy of Melancholy" (1651 edition, volume 2, chapter 2, page 279) spoke of "Arithmetick, Geometry, Perspective, Optick, Astronomy."

"Optics" (the science of light or the medium of sight, i. e., light; that branch of physics which deals with the properties and phenomena of light) in its modern usage is the plural of the adjective "optic" and is used as a noun to render plural the medieval Latin word *optica,* an adaptation of the Greek τὰ ὀπτικά (optical matter; optics). It was plural in origin and form and formerly was so construed ("the Optics"), but now it is always used as singular. In 1579 Leonard and Thomas Digges in "An Arithmeticall Militarie Treatise Named Stratioticos" (page 189) said: "Such was his Fœlicitie and happie successe . . . also in the Optikes and Catoptrikes, that he was able by Perspectiue Glasses . . . to discouer euery particularitie in the Countrey rounde aboute." In 1625 Nathanael Carpenter in his "Geography Delineated Forth in Two Bookes" (1635 edition, book 1, chapter 11, page 244) said, "The Optickes teach vs, all things are seene in the places opposite to the eye." In 1666 Samuel Pepys in his "Memoirs: Comprising his Diary from 1659 to 1669, and a Selection from his Private Correspondence 16 . . ., October 17" said "I do not see that he minds optickes or mathematiques of any sort."

"Optical," meaning "pertaining to or in relation to the sense of sight; vision; ocular," was used in 1570 by John Dee in "A Præface [to H. Billingsley's 'Euclid'] Specifying the Chiefe Sciences, What They Are, Etc." (page 20), in which he stated: "By demonstration Opticall, the . . . Cause thereof is certified." In Ephriam Chambers' translation of Sebastian Le Clerc's "Treatise of Architecture" (1723-1724, volume 1, page 41) appears the following:

> The most perfect Arches . . . consist of a Semicircle; and the Imposts are usually placed on a level with their Centre. There are some Architects, however, who from an Optical consideration, place them a few Minutes lower.

"Optical," meaning "of or pertaining to sight in relation to the physical action of light upon the eye; belonging to optics," was used in 1570 by John Dee in his "Præface to H. Billingsley's "Euclid" (page 48) as follows: "The chief Science of the Archemaster . . . is an other (as it were) Optical Science." In 1663 Robert Boyle in his work, "Some Considerations Touching the Usefulnesse of Experimental Philosophy" (book 1, page 96) said: "An eye thus frozen, may be cut

along that which Optical Writers call the Optical Axis, and then it affords an instructive Prospect."

"Optical," meaning "treating of or skilled in optics," was used in 1570 by John Dee in his "Præface to H. Billingsley's 'Euclid'" (page 48) as follows: "the Astronomer, and the Opticall Mechanicien." In 1605 William Camden in his "Remaines of a Greater Worke Concerning Britaine" (page 203) mentioned "Pecham that Opticall Archbishop of Canterbury who writte *Perspectiva Communis*.

"Optical," meaning "constructed to assist the sight or to enable one to see objects otherwise invisible," was used in 1748 by Lady Luxborough in her "Letters to Shenstone" (April 17) as follows: "It would give me pain to see St. James's, Vauxhall, Ranelagh & C. & C., represented in so lively a manner as I see them through an optical glass, which I have lately purchased, now that I am absent from them."

"Optically," meaning "in an optical manner; by means of light; of optics," was used in 1593 by Richard Harvey in his "Philadelphus, or a Defence of Brutes and the Brutans History" (page 21) as follows: "Brute presently upon his Arriual searched this Iland optically and throughly." In 1656 William Du Gard in his translation of J. A. Comenius' "Latinæ linguæ janua reserata . . . The Gate of the Latine Tongue Unlocked" (paragraph 528) said: "They measure distances optically, by visible lines, with the help of a Quadrant."

"Optician" (obsolete), meaning "one versed in optics," was used in 1687 by John Reynolds in his "Death's Vision Represented in a Philosophical Sacred Poem" (1713 edition, page 15) as follows: "Dr. Cheyne shows from the same Great Optician (Newton) that all Bodies attract the Rayes of Light towards them in Lines perpendicular to their Surfaces." In 1738 "Medical Essays and Observations, Revised and Published by a Society in Edinburgh" (edition 2, volume 4, page 143) contained the following phrase: "whether Physician, Anatomist, or Optician."

"Optician," meaning "a maker of or a dealer in optical instruments" (modern usage), was employed in 1737 by John Chamberlayne in his "Magnæ Britanniæ notita: or the Present State of Great Britain, List of Offices" (page 254) mentioned "Officers and Servants attending . . . the Prince of Wales . . . Tradesmen . . . Optician, Nathaniel Adams." In 1804 Thomas Young in the *Philosophical Transactions of the Royal Society* (volume 94, page 14) spoke of "the blue glass sold by the opticians." In 1868 J. Normal Lockyer in his translation of A. Guillemin's "Heavens" (edition 3, page 494) said: "Our modern opticians contrive to admit more light by means of a superior polish imparted to the surfaces of the object glass."

"Opticist" (rare), meaning "one who studies or is versed in optics," was used as follows in 1884 in the *Popular Science Monthly* (volume 24, page 814): "The real cause . . . is now thoroughly understood by physiological opticists."

"Optometer," from the Greek word ὀπτός (seen; visible), was used in 1738 by W. Porterfield in "Medical Essays and Observations, Revised and Published by a Society in Edinburgh" (edition 2, volume 4, page 185) as follows: "the Instrument formerly mentioned; which . . . I have called an Optometer." In 1801 Young used the word in the *Philosophical Transactions of the Royal Society* (page 34).

"Optometry," meaning "the measurement of visual power," appeared in 1892 in the "Sydenham Society Lexicon of Medicine and Allied Sciences."

"Optometrist," meaning "a person who tests eyes for refractive error," originated in the United States. In 1900 J. E Littlefield suggseted the word "optometist." Later, John C. Eberhardt (*Optical Journal-Review,* June 15, 1932, page 15) suggested the word "optometrist," and in 1903 in the *Optical Journal* (volume 12, page 390) he used the word to refer to "One skilled in Optometry." It is interesting to note that about the same time the British Optical Society adopted the word "optologist" in place of "refracting optician" and in a formal resolution ordered that the "words, 'optology,' 'optological,' and 'optologist,' be employed in the future in all reports of the Association instead of the usual derivations taken from the word 'refraction.'"

"Optometrical," meaning "of or pertaining to optometry," was used in 1903 in the *Optical Journal* (volume 12, page 810).

COMMENT

In this paper I have discussed the English words derived from the Greek words ὀφθαλμός and ὀπτικ-ός and the Latin word *oculus*. The origin of the words "ophthalmologist," "oculist," "optometrist" and "optician" also have been traced.

The first word which appeared in English derived from the Greek word ὀφθαλμός was "ophthalmia," which was used in 1398. In 1543 appeared the now obsolete word "ophthalmy." "Ophthalmic" was first used as an adjective in 1605 and as a noun in 1653. When the word "ophthalmoscopy" was first used, between 1727 and 1741, it was in a different sense than it is today. It was not used in the modern sense until 1851. "Ophthalmoscope" appeared in 1853.

"Ophthalmologist" was first used in 1834; "ophthalmological," in the period from 1839 to 1847, and "ophthalmologic," in 1846.

The first use of the word *oculus* was about 1440 to describe two plants called Oculus Christi.

The first word based on the Latin word *oculus* was the now obsolete word "oculate," which appeared in 1549, one hundred and fifty years after the appearance of the word "ophthalmia." "Ocular" was used in 1597 and "ocularly" in 1600. "Oculist" first appeared in 1615, two hundred and nineteen years before the word "ophthalmologist" first appeared.

"Optic" was first used as an adjective in 1541 and as a noun in 1620. "Optic" was used also in the sense of the science of "sight or light" (optics) in 1611 and to describe one skilled in optics (optician) in 1636. "Optics" in the modern sense first appeared in 1579; "optical," in 1570, and "optically," in 1593.

"Optician" first appeared in 1687, in the sense of "one skilled in optics." In the modern sense, meaning "a maker of or dealer in optical instruments," the word was first used in 1737. "Optometer" appeared in 1738 and "optometry" in 1892. "Optometrist" originated in the United States and was first introduced in 1903.

I suggest that the word "ophthalmologist" be used exclusively in the scientific and medical literature to refer to a physician specializing in the diseases of the eye. I fully realize that popular usage determines whether a word is to be used in a language or not. As far as the words "oculist" and "ophthalmologist" are concerned, both words are used with about the same frequency, with the word "ophthalmologist" used more frequently in the medical literature. Its Greek origin is in keeping with the names of the other medical specialities, practically all of which are based on Greek words. It would obviate a certain amount of confusion, as there would then be only one technical term to designate this medical specialty.

It is interesting to note that there is no statutory definition of the word "oculist," but the courts have defined the word "ophthalmologist." In the case of Stern vs. Flynn, recorded in the *New York Supreme Court,* (volume 278, new supplement, May 14, 1935, page 598) Justice Schenck stated:

> Three terms are generally employed by laymen in connection with the treatment of the eyes: The "oculist," the "optician," and the "optometrist." While a definition of an "optometrist" is contained in the Education Law, there appears to be no statutory definition of the word "oculist," or the "optician."
>
> It would seem that an "oculist," whose technically correct title is that of an "ophthalmologist," is a physician specializing in the diagnosis and treatment of the diseases of the eye. He, as well, examines for the purpose of determining whether glasses are needed, prescribes lenses, when necessary for the correction of vision, and in the practice of his profession is often called upon to perform surgical operations on the eye.

"Eye physician" instead of "eye specialist" is also suggested as a term to be used in the lay press to describe a physician specializing in

the diseases of the eye. "Eye specialist" does not necessarily mean "a physician." The term "eye physician" was first suggested in 1927 at the convention of the Guild of Prescription Opticians (page 19 of the proceedings). In the same year Edward Jackson urged the adoption of this term in an editorial in the *American Journal of Ophthalmology* (Sept. 1927; volume 10, page 705).

SUMMARY

The origin of the words "ophthalmologist," "oculist," "optician" and "optometrist" in the English language is traced and discussed.

It is suggested that the word "ophthalmologist" instead of the word "oculist" be used in scientific and medical literature in referring to a physician specializing in the diseases of the eye.

It is suggested that the term "eye physician" instead of "eye specialist" be used in the lay press in referring to a physician specializing in the diseases of the eye.

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The material for this paper has been obtained mostly from the "Oxford English Dictionary." Permission to use this material has been secured from the publishers, the Oxford University Press.

MALFORMATIONS OF THE POSTERIOR SEGMENT OF THE HUMAN EYE

AN EMBRYOLOGIC INTERPRETATION

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An exposition of the pathogenesis of malformations must of necessity be based on the knowledge of the normal development of the structures involved. The present conception of the malformations of the posterior segment of the eye has been greatly influenced and simplified by the investigations concerning the morphogenesis of the optic papilla and by demonstration of some of the characteristic inherent qualities of the ectodermal anlage.

The interesting studies and wax model reconstructions of von Szily [1] showed that all the early embryonic events, such as formation of the cleft, of the primary dorsal fold, and of the ventral fold, which becomes the link (*Schaltstück*) between the retina and the optic stalk and therewith the first anlage of the primitive epithelial papilla, take place only preparatory to the formation of the latter. Thus, in the rather complex development of the primitive papilla there lies the possibility of a large number of anomalies and malformations. Furthermore, it has been shown by von Szily,[2] Elschnig [3] and others that one of the important characteristics of the ectodermal ocular anlage is an inherent active tendency for growth. This impulse, which is necessary for the normal development, sometimes reaches pathologic dimensions, leading to an abnormal retinal fold at the margins of the cleft which interferes with its closure and often also with the normal formation of the epithelial papilla, resulting in a coloboma, a groove, a scleral pocket or a heterotypic conus. Von Szily also demonstrated that this aberrant growth of the ectoderm is not always limited to the optic vesicle alone but the severest malformations of the optic stalk, such as abnormal width, length and tortuosity, may be present long before the closure of the fetal cleft.

Read before the Section on Ophthalmology at the Eighty-Seventh Annual Session of the American Medical Association, Kansas City, Mo., May 15, 1936.

1. von Szily, A.: Die Deutung der Zusammenhänge der wichtigsten Entwicklungsphasen des Wirbeltierauges, Arch. f. Ophth. **106**:195, 1921.

2. von Szily, A.: Ontogenese der idiotypischen Spaltbildungen des Auges, Mikrophthalmus und Orbitalcysten, Ztschr. f. d. ges. Anat. **74**:1, 1924.

3. Elschnig, A.: Kolobom am Sehnerveneintritt und Conus nach unten, Arch. f. Ophth. **51**:391, 1900.

In this presentation, groups of rare malformations of the posterior segment are discussed with these advances of embryologic knowledge in mind.

ORBITAL APPENDIX OF THE SHEATH OF THE OPTIC NERVE

In the four eyes of this series a hitherto undescribed duplication of the sheaths of the optic nerve could be demonstrated, which formed an appendix of varying length extending into the surrounding orbital tissue. The orbital appendixes have the following points in common:

1. Each contains a central, potential slitlike lumen within which usually sparse remnants of glial tissue can be discovered after careful search.

2. The orifice of this slit is in the subdural space, and there is corresponding to it either a slight invagination of the nerve fibers of the trunk at an obtuse angle or a short extension of delicate bundles of aberrant nerve fibers into it.

TABLE 1.—*Types of Orbital Appendix*

Type	Wall of Appendix	Content of Potential Lumen
1	Duplication of all 3 sheaths	Rudiments of myelinated nerve fibers; neuroglia
2	Duplication of dura	Disconnected accumulations of arachnoid; neuroglia
3	Duplication of dura	Disconnected rudiments of arachnoid

3. The appendix always arises from the inferior surface of the nerve trunk, more often from the nasal side.

4. It is always associated with other malformations of the optic nerve.

In some instances all three optic sheaths participate in the duplication. More often there is no continuous layer of arachnoid, but convolutions of arachnoid are seen here and there within the slit, sometimes surrounding glial remnants or traces of medullated nerve tissue. In other instances there are within the same lumen disconnected rudiments of arachnoid and remnants of neuroglia in direct contact with the dural sheath, or there are barely recognizable strands of arachnoid only, marking the central slit. Thus three types of orbital appendix may be distinguished:

1. An appendix consisting of all three sheaths and containing rudiments of myelinated nerve tissue (fig. 1).

2. An appendix consisting only of a complete dural duplication containing disconnected rudiments or arachnoid and neuroglia (fig. 2).

3. An appendix resembling type 2 but containing arachnoid remnants only, which indicate the position of the central lumen. Type 1 forms already the transition to the pockets of aberrant nerve fibers (fig. 3).

Case 1.—The left orbit of S. Cl., a man 44 years of age, was exenterated on account of a lymphosarcoma of the left lacrimal gland. Vision in the left eye was 1.0 at the time of the enucleation. The eye was sectioned horizontally from above downward. This case was reported in detail by me.[4]

Histologic Observations.—Excepting incipient keratitis, lagophthalmos and small foci of tumor metastasis in the choroid, there were no pathologic changes.

Fig. 1 (case 4).—Photomicrograph of orbital appendix, type 1, containing nerve fibers (*NF*); hematoxylin and eosin stain.

Fig. 2 (case 1).—Photomicrograph of orbital appendix, type 2, containing remnants of arachnoid and of neuroglia (*NG*); Van Gieson stain.

There were, however, some malformations of the optic nerve trunk, consisting of an intrascleral pocket, measuring 2 by 2.75 mm., and an extrascleral pocket formed by the optic sheaths, 2.5 by 3.5 mm., both of which were filled with loops of

4. Klien, B. A.: Ueber abirrende Sehnerven-fasern, Klin. Monatsbl. f. Augenh. **93**:323, 1934.

aberrant nerve fibers, which farther back joined the main trunk again. From the nasal side of the nerve trunk there arose a duplication of all three optic sheaths, which formed an orbital appendix approximately 10 mm. long containing remnants of neuroglia within its central slitlike lumen.

CASE 2.—B. B., a man 43 years of age, suffered a penetrating injury to the right eye one year prior to its enucleation. Retinal detachment and iridocyclitis followed the extraction of the traumatic cataract, and continuous pain necessitated excision of the eye. The previous vision in the right eye was unknown. The eye was sectioned vertically from the temporal side.

Histologic Observations.—There was a perforating wound canal at the lower limbus, with incarceration of the iris and vitreous. Delicate strands of connective tissue extended from the wound canal backward over the inner surface of the corona ciliaris and the axially detached retina. There was also a low equatorial choroidal detachment. The nerve head was drawn forward by the retina. The lamina cribrosa was in situ. The retrolaminar portion of the entrance canal of

Fig. 3 (case 2).—Photomicrograph of orbital appendix, type 3, containing remnants of arachnoid (*A*); hematoxylin and eosin stain.

the optic nerve was severely malformed. The inner third of the sclera, which serves to make up the cribriform plate, was completely separated at the posterior polar region from the outer two-thirds within an area 4 mm. in the horizontal diameter and 3 mm. in the largest vertical diameter. The resulting space was completely filled with loops of aberrant nerve fibers which in places were barely separated from the choroid and caused a prominence toward the interior of the eye of the entire area (fig. 4). The more temporal portion of these aberrant nerve bundles was in direct contact with the sclera, while nearer the entrance canal rudiments of arachnoid appeared around it. All of them joined the main trunk again. From the inferior nasal quadrant of the area just described there arose a scleral duplication forming an appendix, which extended backward and temporalward, ending about 3 mm. behind the posterior pole. Only a few strands and convolutions of arachnoid marked the lumen of this appendix.

CASE 3.—L. Y., a boy 14 years of age, sustained a penetrating injury to the right eye from a steel foreign body six weeks prior to enucleation. Extraction of

the foreign body with a magnet was followed by shrinkage of the eyeball. The previous vision in the right eye was unknown. Vision in the left eye was 1.2. The eye was sectioned vertically from the nasal side.

Histologic Observations.—A wide perforating wound canal, indicated by exudate, hemorrhage and newly formed connective tissue, could be traced from the lower limbus through the lower pole of the lens backward to the sclera, but not penetrating it, just below the nerve head. There were a retrolental abscess and axial detachment of the retina, the remnants of the vitreous cavity and the subretinal space being filled with hemorrhage. The nerve head and the adjoining retina were distorted, partly covered and partly replaced by new connective tissue. The lamina cribrosa was in situ and undisturbed. The nasal half of the retrolaminar nerve fiber bundles bent abruptly nasalward, filling a scleral pocket, returning farther back again to a more axial position. There the lower portion of these bundles did not run parallel to the upper part but took on a vortex-like arrangement which was further emphasized by a similar arrangement of the septums. At the inferior nasal surface of the nerve near this vortex there was

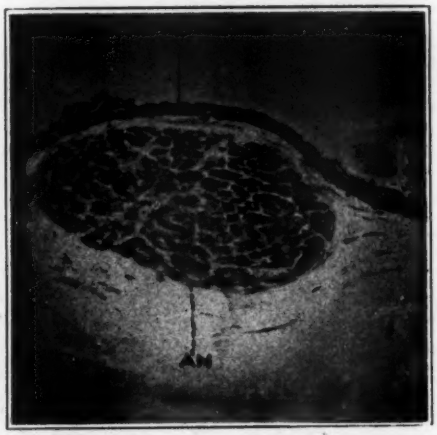

Fig. 4 (case 2).—Photomicrograph of subchoroidal pocket of aberrant nerve fibers (*AN*) causing elevation (*E*) toward the interior of the eye; Weigert stain.

the origin of a dural duplication forming a long narrow appendix which bent backward, downward and temporalward and then curved slightly upward again, containing convolutions of arachnoid, strands of neuroglia and a few faintly medullated nerve fibers. The appendix was fixed in this peculiar position by loose tissue, containing nerves and blood vessels, which connected it with the outer surface of the regular dural sheath.

Case 4.—The right eye of a girl 3 years of age had been enlarging since a violent bilateral corneal inflammation soon after birth. At the time of enucleation vision in the right eye was limited to perception of light. The eye presented a large anterior staphyloma and was removed for cosmetic reasons.

Histologic Observations.—The eye was sectioned vertically. There was a moderately large anterior staphyloma. The lens was absent; the ciliary body was very atrophic; the choroid contained a few foci of infiltration by round cells. There was patchy degeneration of the first retinal neuron such as one finds in glaucoma, and within the more extensive of those areas the pigment epithelium had begun to show irregularities.

The nerve had an oblique entrance with a deep cylindric excavation in the direction from the superior temporal distal portion to the inferior nasal proximal portion. Adjoining the superior margin of the papilla there was a triangular pocket filled with loops of nerve bundles and glial columns, its posterior wall being formed by a few layers of pigmented suprachoroid and a backward sloping sclera and its anterior wall by a glial ridge consisting of four or five layers of glial cells, the anterior layers of which were in the direction of direct continuation of the retina and pigment epithelium. The entire ridge was perpendicular to the glial columns of the nerve (fig. 5).

The lamina cribrosa was absent in the temporal fourth of the nerve, and where present it was displaced posteriorly, as in an early stage of glaucoma. Only a few of the centrally located nerve fibers took a straight course. The rest of them were tortuous, filling on their way backward large pockets, which protruded partly upward, partly downward or temporalward. The more distally situated pockets were intrascleral, while those that were proximal were surrounded by all three optic sheaths. From the temporo-inferior surface of the

Fig. 5 (case 4).—Photomicrograph of superior conus. *AN* indicates aberrant nerve fibers, and *GR*, glial ridge.

nerve trunk there originated a short appendix formed by duplications of all three optic sheaths, which contained a few medullated nerve bundles. The nerve bundles of the upper half and those of the lower half took a separate course, which is schematically shown in figure 6. On lateral view the nerve trunk had the shape of a dumb-bell with the narrow portion about 2 mm. behind the eyeball. Reconstruction of the horizontal view showed the nerve trunk to be very broad in this diameter corresponding to this narrow portion and thus platelike in this region (fig. 7). The central vessels had a general oblique direction downward, nasalward and backward but changed their course twice for short stretches, finally bending downward in a right angle and leaving the optic nerve on the inferior nasal surface 4.5 mm. behind the sclera. An unusual feature was a large artery branching off the central artery within the nerve trunk and running upward and backward.

The macular area was occupied by a lesion 2.3 by 2.4 mm. in size which consisted mainly of a plate of glial tissue, on the inside of which some of the inner

layers of the retina were rather poorly recognizable. This glial plate was thicker in the marginal portion, where it extended for a short stretch under the normal retina. The choroid ceased abruptly adjoining it, and only a thin layer of connective tissue carrying a few small blood vessels and pigmented cells extended across the coloboma. The pigment epithelium, the neuro-epithelium and the outer nuclear and plexiform layers also ended abruptly, with an everted edge in some sections, at the margin of the coloboma. No traces of the lamina basalis could be detected within the lesion.

As table 2 illustrates, the malformation of the sheaths was associated with aberrant nerve fibers in all four of these eyes and in one

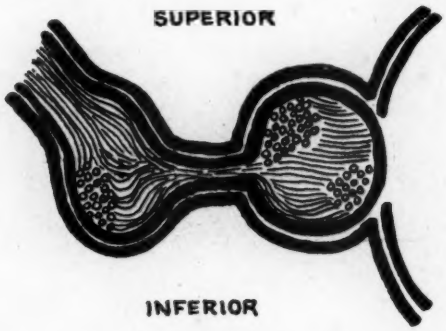

Fig. 6 (case 4).—Diagram of a sagittal section through the nerve trunk.

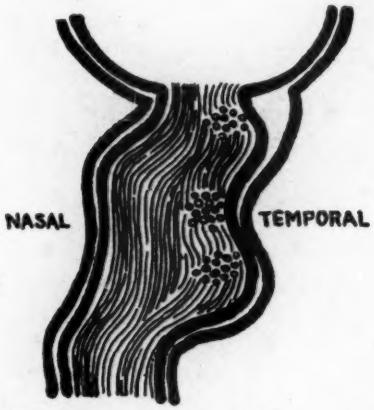

Fig. 7 (case 4).—Diagram of reconstruction of a horizontal section through the nerve trunk.

of them also with a superior conus and a macular coloboma. The association of aberrant nerve bundles with an orbital appendix does not appear to be a coincidence but points to the etiology of the appendix. The neuroglia within it must be interpreted as tissue differentiated from the primary optic stalk. It is possible that at one time during the embryonic stage nerve fibers were actually present within the appendix in each of these four cases, as it is well known that extensive retrogression of nerve tissue can take place.

ABNORMAL COURSE OF THE NERVE TRUNK

The malformation of the second type is characterized by an abnormal course of the entire nerve trunk and not only of parts of it. This anomaly may vary from one abnormal bend to intrascleral loopings and S-shaped formations of the trunk (fig. 8).

CASE 5.—W. M., a man 65 years of age, suffered a perforating injury of the right eye two months prior to enucleation.

Histologic Observations.—The eye was sectioned vertically from the nasal side. There was a gaping perforation in the lower half of the cornea, which was

TABLE 2.—*Orbital Appendixes Observed*

Case	Position of Appendix	Associated Malformations
1	Inferior nasal region	Aberrant nerve fibers
2	Inferior nasal region	Aberrant nerve fibers; abnormal intra-ocular elevation temporal from the papilla
3	Inferior nasal region	Aberrant nerve fibers; abnormal course of optic nerve; vortex arrangement of part of nerve bundles and septums
4	Inferior temporal region	Aberrant nerve fibers; superior conus; macular coloboma

TABLE 3.—*Abnormal Course of the Nerve Trunk*

Case	Nerve Head	Nerve Trunk	Associated Anomalies
5	Very oblique in temporonasal direction	Intrascleral; S-shaped course; derounded cross-section	Branching of central connective tissue strand, carrying artery and vein separately; exit of central vessels from nerve at level of posterior sclera; abnormal intra-ocular elevation nasal to the papilla
6	Slightly oblique in superior-inferior direction	Intrascleral rectangular bend downward behind lamina; triangular cross-section	Hypoplasia of lower half of nerve; branching of central connective strand
7	Very oblique in temporonasal direction	Prelaminar rectangular bend backward; intrascleral rectangular bend nasalward; oval cross-section	Hypoplasia of lower half of nerve; vortex arrangement of septums, glia and nerve bundles of hypoplastic portion
8 (clinical)	Very oblique in temporonasal direction	.....	Superior conus and inferior conus; abnormal elevation temporal to the nerve head, including macular area

filled by prolapsed, necrotic iris. The lower pole of the lens was severely traumatized. The choroid and retina were hyperemic, and the nerve head was moderately edematous. The optic nerve in toto had the following peculiar appearance: The entrance was very oblique, in a direction from the temporodistal to the nasoproximal portion, so that pure cross-sections even of the prelaminar bundles were obtained. The thin lamina cribrosa also was passed in an extremely oblique direction, and after this the nerve remained intrasclerally, running at first nasalward and slightly backward, then slightly upward and forward and again straight nasalward. After this it bent backward in a right angle. Throughout this approximately S-shaped course the nerve trunk was intrascleral, separated from the

choroid by one third of the scleral thickness and completely surrounded by arachnoid. Different nerve bundles took different courses within the nerve, giving the various cross-sections an irregular shape. The central connective tissue strand divided into two branches just before the upward and forward turn of the nerve. The lower of these branches carried the vein, which left the nerve near the convexity of this bend; the other, carrying the central artery, stayed approximately in the center of the nerve, taking the same tortuous course. The artery finally left the nerve on the lower surface of the last backward stretch at the level of the posterior scleral surface. Cross-sections of the optic nerve, obtained at this level before the sectioning of the eyeball, showed only part of the bundles in cross-section, the remaining bundles in longitudinal and oblique sections and cross-sections of a large artery and vein, apparently the central vessels, side by side, in the subdural space. There was no disturbance in the medullation of the nerve fibers. The entire area nasal to the nerve head, which contained the intrascleral nerve convolutions, bulged forward toward the interior of the eye, causing a prominence which would certainly have been visible ophthalmoscopically.

Fig. 8 (case 5).—Photomicrograph of intrascleral loops of the nerve trunk causing elevation (*E*) toward the interior of the eye; Weigert stain.

Cases 6 and 7.—In two other eyes, both of which were enucleated a short time after a penetrating injury, abnormal intrascleral bends of the optic nerve could be demonstrated. In one of them (case 6) there was a rectangular bend from above downward, beginning in the intralaminar region with tilting of the lamina, associated with hypoplasia of the anterior, i. e., inferior, half of the optic nerve, and a splitting up of the central connective tissue strand into two portions. In the other of these two eyes (case 7) there was an intrascleral rectangular bend of the nerve nasalward, also associated with hypoplasia of the lower half and a peculiar vortex arrangement of the nerve bundles, glial columns and septums of the hypoplastic portion.

The explanation for these malformations—the aberrant nerve fibers, as well as the duplication of the optic sheaths and the abnormal course of the entire trunk—is an abnormal growth of the optic stalk. This may lead to unusual length and tortuosity of the stalk or to pocket-like

excrescences, which may either become filled with nerve fibers at the time of neurotization or collapse and later be traceable only by glial tissue within a duplication of the optic sheaths. The time of this developmental disturbance has to be placed before the time of differentiation of the surrounding mesoderm into the sheaths of the optic nerve and before the neurotization of the stalk.

Thus there is only a topographic and not a genetic difference between aberrant nerve fibers (Klien [4]), an orbital appendix or an anomalous course of the entire nerve, on the one hand, and the malformations of the primitive epithelial papilla, such as coloboma, and the formation of a groove, pocket or conus, for which an anomalous tendency of ectodermal growth has been proved, on the other hand.

In cases in which these anomalies of the optic nerve are solely retrobulbar, they are of interest primarily to the pathologist. In cases in which they occur within the eyeball, causing a localized prominence of the fundus, they are of some interest to the clinician as well. In cases 2 and 5 there were such nerve anomalies located within the eye itself, and had it been possible prior to enucleation to examine the fundus in these eyes an elevation of the choroid and retina overlying these intrascleral nerve anomalies would have been seen ophthalmoscopically.

Since these nerve anomalies are usually associated with malformations of the disk, it would seem worth while to look for differences of fundal level, especially about the disk and macula, whenever examination of the fundus shows malformation of the disk.

Such a fundal prominence accompanying malformations of the disk was present in the following case (fig. 9):

Case 8.—W. F., a man 44 years of age, had a left divergent squint with lifelong amblyopia of the left eye, the vision of which even with corrected refraction (a +2.25 sphere +1.00 cylinder, axis 95) was not more than perception of movements of the hand.

Examination of the fundus revealed a very oblique entrance of the optic nerve, with a superior and an inferior conus. The entire posterior polar region temporal to the disk was of much lighter color than the remaining part of the fundus and from a maximum elevation of 3 diopters in its central portion sloped evenly and smoothly to a gradual transition with the surrounding fundus. The macular reflex was distorted, and there was no foveolar reflex. Incidentally, the stump of a persistent hyaloid vessel was attached to one of the inferior temporal vessels.

The oblique entrance of the nerve in this case was not that seen in a myopic eye but was a real malformation of the nerve. The large prominent area adjoining the disk suggests the existence of a more extensive anomaly than that seen with the ophthalmoscope.

In general, a central elevation of this type would make the refraction of the macular area more hyperopic than that of the surrounding retina. Further, in cases in which the fovea is located not at the summit

of the elevation but on its slope, the tilting of the fovea would impair the clarity of the retinal image to such an extent as to cause suppression and consequent amblyopia in cases of severe involvement.

The differential diagnosis from other conditions causing elevations of the retinal surface, such as tumor and inflammatory pseudotumor, should not be difficult, as in the congenital condition the surface of the retina is smooth, owing to its accurate coadaptation to the elevations of the underlying coats. Thus there is complete absence of the fine folds and wrinkles of the retina, which are the inevitable consequence of irregularities produced by acquired conditions.

As the pathogenesis of the orbital appendix and the aberrant nerve fibers has already been discussed, there remain for consideration the superior conus and the macular coloboma.

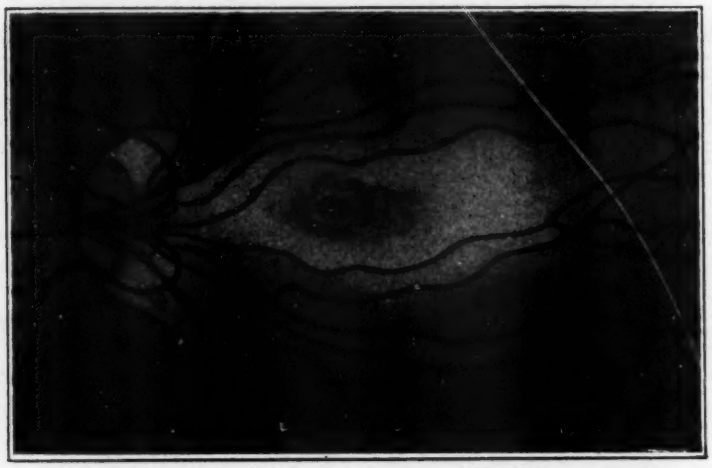

Fig. 9 (case 8).—Malformation of the optic nerve head and elevation of the region of the posterior pole.

SUPERIOR CONUS

Preparatory to the formation of the embryonic link, the first anlage of the primitive epithelial papilla, there arises a dorsal retinal fold, the main purpose of which is the reservation of space for the reception of the epithelial papilla (von Szily [1] and Seefelder [5]). As this fold is only the expression of purposeful topographic and chronological differences in growth, it undergoes involution as soon as its purpose is fulfilled. Thus after the closure of the cleft and the formation of the primitive papilla the retarded growth of the retina within this median dorsal fold is accelerated and soon reaches the point at which the

5. Seefelder, R.: Ueber die Entwicklung des Sehnerveneintritts beim Menschen, zugleich ein Beitrag zur Frage der Faltenbildungen in der embryonalen Netzhaut, Arch. f. Ophth. **106**:114, 1921.

retina is in contact with the outer wall of the secondary optic vesicle, as in the lateral portions, leaving only a slitlike remnant of the optic ventricle at each side of the epithelial papilla. The lack of restoration of this equilibrium of ectodermal growth leads to severe malformations. In microphthalmic eyes the dorsal retinal fold may persist and form the so-called retinal septum, the connection of which with the vasa hyaloidea is sometimes still demonstrable.

A minor disturbance in the involution of the median retinal fold, resulting in partial persistence, is the most probable origin of the glial ridge (fig. 5) already described. What precipitated it cannot be ascertained, as not much is known of the interaction of growing tissues. Abnormal length or shape of the primitive link is suggested by the loops of nerve fibers and glial columns in the triangular space behind it, by the sloping scleral margin and by the general anomalous direction of the nerve head and physiologic excavation, and it would seem that at the time of balancing growth the median part of the retina came in contact not only with the outer wall of the secondary optic vesicle but with the wall of the abnormally shaped, curved or widened primitive papilla, thus forming a permanent glial ridge the anterior layers of which must be derived from the primitive retina and the posterior layers from the optic stalk.

These topographic relations are better demonstrable on a sagittal section through the nerve of a microphthalmic eye which showed similar anomalies but less retrogression of the involved tissues, thus giving a clearer picture of preceding events (fig. 10).

CASE 9.—The nerve head and the central vessels showed a rectangular bend from above downward. The uppermost nerve fiber loops filled a triangular space the posterior wall of which was formed by backward sloping sclera and a few delicate fibers of connective tissue containing a few blood vessels and the anterior wall of which consisted of the terminations of the pigment epithelium, of the lamina basalis and of the choriocapillaris and, farther inward, of a glial ridge to the inner surface of which distorted and folded retina was applied. In the upper half of the nerve there was complete separation of the choroidal portion of the lamina cribrosa from the scleral portion, both of which converged downward and joined each other at the lower wall of the entrance canal of the optic nerve.

In this case a malformation of the primitive epithelial papilla, which resulted in a permanent abnormal convexity of the upper portion of the nerve head, also had prevented normal apposition of the inner and the outer layer of the secondary optic vesicle within the region of the primitive dorsal retinal fold. The retina instead came into contact with the upper wall of the primitive link, thus giving rise to the persistent ridge of glia and distorted retina which formed the anterior wall of the triangular pocket filled with aberrant nerve loops.

The anomalies in cases 4 and 9 are similar types of malformation, but of different degrees, and must be classed as superior coni.

The only other histologic description of a superior conus was given by Tertsch [6] in 1913. He also observed aberrant nerve fibers in a pocket located similar to the ones described here.

Thus, the rare superior conus, like the other heterotypic coni, is a malformation of the primitive epithelial papilla and is of such a kind as to lead to a disturbance in the normal involution of the primitive dorsal retinal fold.

MACULAR COLOBOMA

While the etiology of the typical coloboma of the uveal tract has been satisfactorily explained by the repeatedly mentioned investigations of von Szily, there has been no generally accepted explanation for atypical choroidal coloboma, including that of the macula. Many theories have attempted to explain the pathogenesis of the latter.

Fig. 10 (case 11).—Photomicrograph of a superior conus in a microphthalmic eye. *PR* indicates persistent dorsal retinal fold; *GR*, glial ridge, and *AN*, aberrant nerve fibers.

A priori, an inflammatory origin has to be carefully considered for all congenital macular lesions. Some authors, such as Mann [7] and Janku,[8] have emphasized that the histologic appearance of a macular coloboma differs in no way from that of an old lesion due to chorioretinitis. They strongly support the pathologic theory and see in intrauterine inflammations the cause for all atypical colobomas. The cases of congenital macular lesions which may be explained by this theory

6. Tertsch, A.: Der Conus in atypischer Richtung, Arch. f. Ophth. **84**:530, 1913.

7. Mann, I.: Abnormal Conditions of the Macular Region, Usually Classed as Colobomata, Brit. J. Ophth. **11**:99, 1927.

8. Janku, L., in Henke, F., and Lubarsch, O.: Handbuch der speziellen pathologischen Anatomie und Histologie, Berlin, Julius Springer, 1931, p. 30.

have been summed up completely by Mann. But not all types of congenital macular defect can be brought under this one heading. Some of them have to be considered true malformations to which the name coloboma may be correctly applied.

The strongest arguments for the developmental theories versus the pathologic theory are:

1. The heredity of macular defects. In 1927 Claussen [9] reported on a family of six, consisting of the father, four children and the father's sister, each member of which had a congenital macular defect. All the colobomas resembled one another strikingly, and two of them were associated with extensive medullation of retinal nerve fibers.

2. The association of macular coloboma with other malformations.

A round macular defect with the typical appearance of a macular coloboma has been found in cyclopic eyes (van Duyse [10]). Some reports in the literature of cases of macular coloboma, accompanied by a description of the clinical picture, mention simultaneous malformation of the optic disk (Clarke [11] and van Duyse [12]). These cases and the observations in eyes such as the one reported on here, in which a macular coloboma is combined with malformations of the optic nerve head and trunk, suggests an early contemporary disturbance of the optic vesicle and optic stalk, leading on the one hand to the anomaly of the nerve and on the other hand to the congenital macular defect. However, the exact mechanism of the pathogenesis is undetermined as yet.

Among the developmental theories, two especially have to be considered:

1. Aberrant differentiation of the cells of the secondary optic vesicle within a circumscribed area.

2. Aberrant growth of the primary or secondary optic vesicle.

Concerning the first theory, Seefelder [13] had demonstrated in a chicken embryo a large area, not connected with the fetal cleft, where the outer layer of the secondary optic vesicle had not been differentiated into the pigment epithelium, several layers of unpigmented epithelium in a primitive stage of development replacing it. Only traces of choroid were present behind it. Considering that this area would have undergone in later life a far reaching retrogression, as other parts of the optic vesicle and stalk do, which later are traceable only through the presence

9. Claussen: Zur Frage der Vererblichkeit der Makulakolobome, Klin. Monatsbl. f. Augenh. **81**:385, 1928.

10. van Duyse, D.: Pathogénie de la cyclopie, Arch. d'opht. **29**:65, 1909.

11. Clarke, E.: Coloboma at the Macula, Brit. J. Ophth. **11**:98, 1927.

12. van Duyse, D.: Pathogénie des colobomes choriorétiniens atypiques, Arch. d'opht. **36**:22, 1920.

13. Seefelder, R., in Henke, F., and Lubarsch, O.: Handbuch der speziellen pathologischen Anatomie und Histologie, Berlin, Julius Springer, 1931, p. 29.

of a very small amount of neuroglia, one can visualize a resemblance of this area in later stages to the appearance of a macular choroidal coloboma such as the one described here.

Aberrant differentiation has been observed also by von Hippel [14] and others in microphthalmic eyes, where the inner layer of the secondary optic vesicle was partially differentiated into pigment epithelium instead of retina; this is only one more illustration of the pluripotential character of the cells of the secondary optic vesicle.

The argument against this theory, that lack of normal differentiation of the macular area would prevent or inhibit the differentiation of the rest of the retina, as the normal process of differentiation begins in the macula and spreads from the posterior pole toward the periphery, is based on the assumption that a stimulus is exerted from the central area on the rest of the primitive layer and as yet lacks an anatomic foundation.

Aberrant differentiation only would, however, not explain the ectasia sometimes associated with macular coloboma. The second theory has been one of the oldest attempts to explain macular coloboma, but in the beginning it was based mostly on misconceived ideas of embryonic development. At present it is appearing in a new light, since von Szily's investigations, by which it was proved beyond doubt that there may exist within the ectodermal ocular anlage inherent tendencies of anomalous growth. The aberrant growth of the optic vesicle need not be confined to the margins of the fetal cleft, where the resulting retinal duplications lead to formation of the typical colobomas and orbital cysts, but von Szily showed that there are still earlier anomalies, such as abnormal length of the primary optic vesicle or early asymmetry of the two halves of the retina. It will have to be the aim of further pathogenic and embryologic studies to determine the consequences of such earliest anomalies of ectodermal growth as possible fold formations not connected with the cleft, which would be followed by defective differentiation of the cells of the neuroderm, as in the case of those causing typical coloboma and orbital cyst.

Considering the great variety of malformations of the ocular anlage in a very early developmental stage, it is not necessary to look for one single factor in the pathogenesis of the true macular coloboma.

SUMMARY AND CONCLUSIONS

Three types of a hitherto undescribed duplication of the optic sheaths, which forms an orbital appendix of varying length, are demonstrated.

An orbital appendix, aberrant nerve fibers and an abnormal tortuosity of the entire nerve trunk are frequently associated anomalies which represent a malformation of the ectodermal, primitive optic stalk.

14. von Hippel, E.: Mikrophthalmus congenitus, Colobom, Rosetten der Netzhaut, Aniridie und Korektopie, Beitr. z. path. Anat. u. z. allg. Path. (supp.) **7**: 257, 1905.

Intra-ocular location of such anomalies may cause a prominence toward the interior of the eye. Careful attention to differences of level of various portions of the fundus in all eyes with a visible anomaly of the optic disk may therefore be of value. Observations of otherwise unexplainable elevation suggest, then, a more extensive malformation of the optic nerve than that visible clinically.

The superior conus is a malformation of the primitive epithelial papilla of such a kind as to prevent, at the time of balancing growth, the normal coadaptation in the region of the primitive dorsal fold of the inner layer of the secondary optic vesicle to its outer layer.

Other malformations of the nerve frequently associated with the aforementioned anomalies are: hypoplasia of the lower half of the nerve, branching of the central connective tissue strand, exit of the central vessel from the nerve at an unusual place and a vortex arrangement of nerve fibers, glial columns and septums within a circumscribed area.

Points in favor of the developmental versus the pathologic theory of the pathogenesis of the congenital macular coloboma are: (*a*) the not infrequent association with other early ectodermal malformations of the eye, as shown in the case reported here and in reports throughout the literature, and (*b*) its heredity.

ABSTRACT OF DISCUSSION

Dr. Henry C. Haden, Houston, Texas: Dr. Klien has been fortunate in finding such anomalies, and her explanation of their origin is interesting. She has reported so many cases and described them in such detail that time will not permit of the discussion of each case. I shall therefore confine myself to the consideration of the general principles of each group. First, concerning the orbital appendage of the optic nerve; reports of an appendage such as Dr. Klien has described are unique in the literature, and I have not seen such an anomaly. However, there is a condition which is closely allied to it, namely, optic nerve fibers coursing outside the nerve in the tissues of the orbit, which have been mentioned by Fuchs, von Szily and Scheerer.

I have sections of a 67 mm. fetus in which nerve fibers can be seen leaving the anlage of the optic nerve through a gap in the anlagen of the sheaths and running into the surrounding mesoderm, which develops into the orbital tissues. They were surrounded for at least part of their length by nuclei and capillaries which were continuous with those forming the anlagen of the sheaths of the optic nerve.

(A slide was shown.)

Had it been possible to have seen the nerves with an orbital appendage at the same period in fetal life as those of my sections, some of them may have had a similar appearance, but not all; for, according to Dr. Klien's description, the nerve bundles in certain of them must have returned to the optic nerves after making a loop.

Dr. Klien's theory that this anomaly is brought about by overactivity of the tendency to growth inherent in the ocular anlage which produces an abnormal fold in the optic cup at the margin of the cleft is presumably correct. Under normal conditions the active growth produces a piling up of the inner layer of the optic cup along the fetal fissure and an eversion of it near the upper end of the fissure, where it forms a light-colored line of closure. It is not unreasonable to believe that the same inherent activity is present in the stalk and that it is subject to an abnormal overgrowth similar to that which occurs in the inner layer of the optic cup. If it should occur along the invaginated portion of the stalk it could produce eversion of the undifferentiated, nucleated protoplasm of its walls.

The eversion must necessarily occur earlier than the closure of the invaginated portions of the stalk, for nerve fibers grow back into the lower portion of the stalk before the invagination has disappeared. If such eversion occurs, it is an extension of the nucleated plasmodium of the stalk into which the axons of the ganglion cells grow and initiates the changes that cause it to develop into the optic nerve. Therefore, it is fairly reasonable to believe that fibers might grow into this offset, the nuclei of which would develop into glial cells and the surrounding mesoderm into sheaths continuous with those of the nerve.

Second, concerning the irregularities in the shape and direction of the optic nerve canal and the intrascleral loop of nerve fibers, conus and abnormality of the lamina cribrosa, these malformations are also the result of abnormal activity of the ectoderm. As they are intimately associated with the surrounding mesoderm, it is difficult to get rid of the idea that it has not something to do with their development. However, its participation is entirely secondary, for the whole pattern of the optic nerve up to its junction with the retina is laid down in ectoderm before the mesoderm has begun to form its sheaths or invade its substance.

Dr. Derrick T. Vail, Cincinnati: The chief matter of importance presented by the essayist, the *Schaltstück,* or intercalated portion, of von Szily, deserves more emphasis, I think, than is given in the paper, since, as was pointed out by her, the maldevelopment of this structure probably results in all the various anomalies described, from the coloboma of the optic nerve to what Weve called ablatio falciformis congenitalis (*Arch. f. Augenh.* **109:** 371, 1935), and finally the ophthalmic mass of microphthalmos with a retinal septum, or pseudoglioma.

Kiewe (Beitrag zur Kenntnis der angeborenen Missbildungen des menschlichen Auges, *Arch. f. Ophth.* **135:** 227, 1936) discussed the *Schaltstück* as follows:

"At the time when the primary optic vesicle is transformed into the secondary optic cup by intercalation the growth of the ventral portion is retarded. Thus the well known ventral cleft of the cup is formed, which extends to the distal end of the stalk of the optic cup. . . . As the secondary optic cup continues growing the margins gradually approach until they unite. While this process of unification progresses in a distal and proximal direction, the groove of the stalk which contains the hyaloid artery is becoming completely closed off and becomes situated within the lumen of the stalk as a closed tube. . . . Its importance consists in the fact that through its presence and intervention it allows

the developing nerve fibers of the retina to be guided into the stalk of the optic cup and into the future optic nerve. . . . The closure of the fetal cleft of the optic cup and simultaneously the completion of the anlage of the primitive disk occur during the fourth and fifth weeks of fetal development. Consequently, all changes of the disk must occur at the same period, except those secondary to mesodermal vascular and connective tissue."

The maldevelopment of the hyaloid artery may play a major rôle in causing these various anomalies of the posterior pole. A pathologic combination of hyaloid artery and *Schaltstück* then may account for all these anomalies, which, when abstracted, reveal themselves to be but various stages. Thus analysis of the orbital appendage, regarding which Dr. Klien has made an important original contribution, reveals that its foundation rests on a disturbance in the formation of the intercalated portion and the fetal fissure of the optic stalk, as is proved by the potential slitlike lumen opening into the subdural space, and especially the origin from the inferior nasal surface of the optic trunk.

In many instances the anomaly is congenital and familial. Under the term ablatio falciformis congenitalis Weve described seven cases of the anomaly that Dr. Klien discussed in case 8 and produced evidence that this is a familial, congenital and possibly recessive condition. The anomaly varies from a barely perceptible sector of ablatio pellucida to the characteristic picture of pseudoglioma. In the most characteristic form the retina shows a duplication or fold which spans as a sail the region between the optic disk and the lens and ciliary body. This anomaly is found temporally and below.

In addition many of these eyes may show on careful investigation other congenital neuro-ectodermal dysplasias. For example, de Vries' (cited by Weve) patient with microphthalmos and pseudoglioma—a boy aged 11—died of a progressive neurologic disease, and neurofibroma and endothelioma were found in the orbit.

A patient of mine aged 2 has a congenital microphthalmic eye with pseudoglioma and evidence of retarded neuro-ectodermal development.

Van Bogaert has recently presented an extraordinary paper on the subject of congenital neuro-ectodermal dysplasias (Les dysplasies neuro-ectodermiques congénitales, *Rev. neurol.* **63**: 35, 1935).

DR. BERTHA A. KLIEN, Chicago: I thank the discussers for the interesting comment. Dr. Haden is to be congratulated on the possession of this interesting specimen. It is a study of this kind of specimen that will help to discard the mesodermic theories concerning the pathogenesis of these malformations.

I wish to mention the only histologic report of a superior conus, which was made by Tertch in Vienna in 1913. This superior conus was diagnosed clinically. Histologically, Tertch noted a similar triangular pocket above the nerve, which was filled with nerve fibers.

I am grateful to Dr. Vail for pointing out some of the differential diagnostic values in studying malformations of the disk. The malformation of the disk which he has shown in the last picture has been described by von Szily. I believe that this author gave it the name of conical disk, and it has been diagnosed occasionally as beginning choked disk.

CHOICE OF A SURGICAL PROCEDURE FOR STRABISMUS

H. G. MERRILL, M.D.
SAN DIEGO, CALIF.

P. Chalmers Jameson in the beginning of a paper read before the American Ophthalmological Society on June 27, 1932, made the following observation:

> On visiting different clinics abroad and at home and on interrogating various surgeons, one is struck by the fact that while there are many operations on ocular muscles in existence, usually only one is used by each surgeon or clinic, or one routine is practiced and advocated for the correction of most of the types of squint and this selection is based more on the surgeon's leaning toward a favored operation than on the consideration of that which is best adapted for the particular type of squint which exists.

That such a tendency exists has been to me a matter of thought and concern.

No one operation is or can be ideal in all cases. Should one argue that because a girdiron incision is to be preferred for some appendectomies the abdominal surgeon should not at times use a midline or a right rectus incision?

Roughly, then, what criteria are there to guide one in selecting a procedure once one has found that a patient with strabismus requires operation for relief? I am today showing slides illustrating results of treatment of strabismus of three general types, each pair of eyes shown before and after one operation on one eye. They present three procedures which my associates and I have come to use because of results obtained in these three types of nonparalytic squint.

TUCKING WITH ADVANCEMENT, WITH GUARDED PARTIAL TENOTOMY OF THE OPPOSING MUSCLE

Case 1 is that of a boy with a rather extreme deviation but in whom the temporary disfigurement of an unsightly bulging area for several months would be unimportant. In this case, as in all cases of this type, we used tucking with advancement of the right external rectus muscle, combined with guarded tenotomy of the right internal rectus muscle. Whether the lengthening is accomplished by partial tenotomy or by recession depends on the case. I speak now not of the

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President's address read before the Pacific Coast Oto-Ophthalmological Society, Monterey, Calif., April 13, 1936.

tucking operations frequently seen today but rather of the type of tucking with advancement practiced more than twenty years ago, before its good effects were attenuated by numerous modifications and "improvements."

Recession is limited to squint which is not too extreme, because, of course, one must never reattach the muscle back of the equator. Recession, however, appeals to one as being precise and preferable where applicable. By the very mechanics of the procedure one permanently weakens the pull of a muscle by setting the muscle insertion back on the eyeball. This is in some cases exactly what one wishes to do, and so one chooses to produce recession of the muscle rather than merely to lengthen it. Partial or guarded tenotomy, on the other hand, is to be used in cases in which the deviation is extreme and yet in which a stronger pull, because of preserving the normally placed insertion, is the result to be desired. When this operation is carefully performed, with avoidance of trauma between the muscle and the globe resulting in adhesions which may bind the muscle to its sheath, the muscle will not reattach to the ball back of the normal point of insertion. The

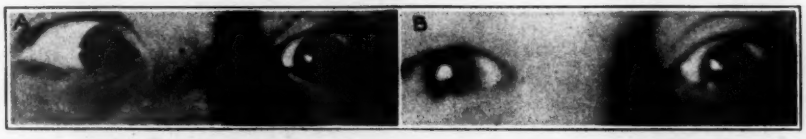

Fig. 1 (case 1).—*A*, appearance of eyes before operation. *B*, appearance following tucking with advancement of the right external rectus muscle, coupled with guarded partial tenotomy of the right internal rectus muscle.

muscle will continue to pull as formerly, thus preserving good useful convergence. Even if the muscle fiber is decreased in the area of the tenotomy, an elongated tendon exists in its place, and sufficient muscle fiber is present back of this tendinous area to give proper motility after the eye has been made to rest with normal tonus in its primary position. Some surgeons have advocated only central tenotomy for fear that unbalanced partial tenotomy would lead to cyclophoria. When healing is completed, however, these tendons pull from the uncut insertion, and if any cyclophoria results it is temporary.

It is well recognized now, or it seems to me proper, that some sort of partial tenotomy or recession should practically always be combined with any shortening procedure practiced on the opposing muscle in the correction of actual squint.

In these cases of combined lengthening and shortening how much one shall shorten or lengthen is a question frequently asked by the younger ophthalmologists. The answer is this: Lengthen sufficiently so that the eye may be turned easily to, and held in, the desired position by the muscle shortened, regardless of the shortening procedure used. If

this is done the same good results will be attained whether one shortens 3 or 5 or any other number of millimeters. As Dr. O'Connor has put it, "The shortening is the positive and determining factor," while the lengthening must be sufficient for the result desired. One may as well disregard mathematical formulas of a given number of degrees to each millimeter of recession, no matter how logical they sound in theory. This remark applies to a combined shortening and lengthening procedure.

Tucking with advancement, as illustrated by case 1, is most applicable in cases of squint of high degree, either internal or external. It is usual with this method to correct the condition satisfactorily at one operation on the muscles of one eye without weakening convergence, retracting the eyeball or limiting motility. Any one who would take the trouble to examine these patients carefully after operation would concur in this statement. As for retraction of the eyeball, if lengthening is sufficient the eyeball will rotate, not retract, when the opposing muscle is shortened.

What is sought is comfortable binocular single vision with useful convergence. In cases in which this is not possible, at least there must be cosmetically straight eyes.

In the most extreme deviations one will do well to distribute the correction between the two eyes. If, however, it is possible to lengthen the contracted muscle so that the eye may be turned to the front and held there by the muscle one shortens, without retraction of the globe or undue weakening of convergence, that is, if it is possible by operating on the muscles of a single, often amblyopic, eye to accomplish the desired results, one is not justified in resorting to repeated operative procedures. It will be found in actual practice that this is possible in a much larger proportion of cases than has been generally supposed. Frequently, by selecting the procedure according to the indications of the condition, my associates and I operate for strabismus once only and on one eye only. We are not sensitive about the point, however, and willingly reoperate whenever necessary.

A trick well worth remembering in advanced tucking operations is this: One may gage nicely the final result of a tuck by the day on which one removes the anchor stitches. Squint is always overcorrected on the operating table, and the anchor stitches are removed in from one to three weeks, depending on the exactness of the results attained. The sooner the stitches are removed the less the effect will be. After some experience one may with rather nice exactness predetermine the results.

RESECTION WITH ADVANCEMENT, WITH PARTIAL GUARDED TENOTOMY OF THE OPPOSING MUSCLE

Case 2 is that of a girl with extreme alternating internal strabismus having also a nasal upshoot. The one operation which has been done so far in her case is resection with advancement of the right external

rectus muscle, coupled with partial tenotomy of the right internal rectus muscle. As will be seen, the results are not yet perfect. Resection was chosen in her case to avoid the temporary elevation always remaining for a few months after the advanced tucking operation. Perhaps if the tuck had been chosen parallelism might have been attained in the one operation. It seems in the hands of my associates and me to accomplish more than any other procedure, but there are often other considerations besides immediate accomplishment, as there were in case 2. I am not, however, in sympathy with writers who give as an advantage for any method the fact that it does not accomplish too much at one time. There are, of course, pitfalls for the young operator who attempts too much at one time, but, other conditions being favorable, there is no such thing as getting a patient too nearly well at any operation. One should accomplish all that one can at one operation and limit that operation to the amblyopic eye, if this is feasible, and one will be agreeably surprised to find that one such operation often accomplishes the desired results.

Fig. 2 (case 2).—*A*, appearance of the eyes before operation. *B*, appearance after resection with advancement of the right external rectus muscle and guarded partial tenotomy of the right internal rectus muscle. The results are not yet perfect.

First, in operating on any eye for squint, my associates and I give our attention to the primary defect. After its correction the secondary dysfunction often disappears without need for further operative intervention. In the few cases in which it does not one may operate later; for instance, one may do a tenotomy on the inferior oblique muscle to correct a nasal upshoot. The patient in case 2 looked on first examination as though she might require this, but when the lateral deviation is fully corrected the results will be satisfactory. In this case the condition was true alternating strabismus and could not therefore be benefited by orthoptic training; this leads me to digress a moment from the main issue.

Any patient possessing second degree or true fusion can be and should be trained in depth perception before operation. With stereoscopic vision established, the desire for fusion will complete and make perfect any near alinement obtained by operative means, especially if after operation the eyes are not bandaged too long but are both left open during the latter part of the healing process.

Every examination of the eyes should include tests of ductions, phorias for near vision and convergence amplitude, as well as the less important tests of phorias for distance. In cases of muscular disturbances the power of stereopsis and its amplitude must be ascertained. If an outward imbalance or out-turning is due to a too strong action of the external rectus muscles a different procedure is demanded than if the same trouble is due to weak internal rectus muscles. The tests indicated are not greatly time consuming, as is erroneously supposed. I have recorded the results as a routine in more than 20,000 patients seen in private practice. These tests are, in fact, time savers, because in the light of their findings prolonged training in cases in which such treatment is doomed from the first to failure need not be attempted. Among the patients mentioned who were seen in private practice, 4.3 per cent had strabismus, but only one of ten of these patients with strabismus was subjected to operation. Careful estimation of the state of refraction coupled with well selected persistent and prolonged training will cure about 60 per cent of patients with strabismus without any operation. When, however, one is certain that the condition requires surgical correction, one should operate as early as possible and by the method best suited to the particular condition. The operation should be followed by training until the result is perfect or as nearly perfect as the present knowledge and present methods can make it.

The fact that the untrained business getter displays paraphernalia for orthoptic training in his office is no reason why the ophthalmologist should not utilize them. Like other surgical instruments, they require adequate training and judgment for proper use. Even a scalpel must be wisely guided.

The causes of strabismus, my associates and I believe, lie in a large measure elsewhere than in the orbit. Some recent work by Aubaret and Jayle in France indicates that hyperexcitability of the static labyrinth may be a factor in strabismus. Here reference is made to the saccule and vestibule, in contradistinction to the kinetic labyrinth composed of the semicircular canals. Certainly, ocular nystagmus with its quick component in one direction can be neutralized and overcome by induced vestibular nystagmus having its quick component in an opposite direction. Perhaps the inability to induce rotatory nystagmus might indicate difficulty with the oblique muscles. Labyrinthine tonus and oculomotor tonus are of great importance. Monocular nystagmus versus binocular nystagmus is also interesting.

O'CONNOR CINCH SHORTENING, WITH RECESSION OF THE OPPOSING MUSCLE

In case 3 there was a less extensive deviation. We used a Jameson recession of the left external rectus muscle combined with the O'Connor

cinch shortening of the left internal rectus muscle. The results were perfect, which observation is pleasing to the ears of all truly Western ophthalmologists. In perfect fairness, however, I must report the development of a satisfactory desire for fusion with binocular stereoscopic vision in this case.

For lateral deviations of moderate degree, for all phorias requiring a shortening operation and for all but the most extreme vertical deviations, the O'Connor cinch shortening operation is, in my experience, the surest, easiest and most certain procedure known. It seems to me that every ophthalmic surgeon should know it and use it. One vertical deviation for which this would not be the operation of choice was reported by me at the 1935 meeting of the Western Ophthalmological Society. In this case there was left hyperphoria of 18 degrees, which was converted in one operation on the one eye to right hyperphoria of 2 degrees. However, cases of such extreme deviation are rare.

Parenthetically, let me say also that the O'Connor method of muscle transplantation for paralysis of the sixth nerve is at present, in my opinion, decidedly the operation of choice. The slides illustrating case 4

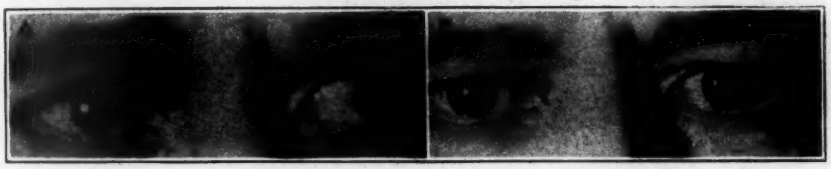

Fig. 3 (case 3).—*A*, appearance of the eyes before operation. *B*, appearance after shortening of the left internal rectus muscle by the O'Connor cinch operation, combined with recession of the left external rectus muscle.

show the eyes of a child of 2½ years who was operated on two weeks ago for paralysis of the sixth nerve on the left side. A 4 mm. recession of the left internal rectus muscle was done, followed by transplantation of the inner two thirds of the left superior rectus muscle and the inner two thirds of the left inferior rectus muscle, both the transplants being placed into the paralyzed tendon of the external rectus muscle by the method of Dr. O'Connor. The results are rather satisfactory, considering the difficulty in such cases.

As many ophthalmologists know, Eastern operators have for the past twenty-two years been subject to increasingly severe criticism by Western ophthalmologists, and especially by those in the region of San Francisco, for their lack of appreciation of the O'Connor cinch shortening procedure. With rare exceptions, they have not taken the trouble to try it, and unless they learn and use it, how can they appreciate it?

On the other hand, many Western ophthalmologists have taught that it is the procedure of choice for all operations for strabismus,

whether the condition is mild or excessive. In this they lay themselves open to the same criticism which they voice toward their Eastern confrères. No procedure known is applicable in all cases.

The successful surgeon specializing in operations on the muscles of the eye must be able to use and use with skill various operative procedures. Let him favor one or the other with which he has become most familiar, but let him not, when indications point otherwise, fail to avail himself of definite benefits which various good operations hold.

SUMMARY

I have reported three cases of strabismus, of the following types: (*a*) Extreme lateral deviation in which the temporary disfigurement of a bulging area was not too objectionable and for which my associates and I, therefore, used tucking with advancement of the external rectus muscle together with guarded partial tenotomy of the opposing muscle. (*b*) Extreme lateral deviation in a patient who did object to any avoidable disfigurement. In this case we have used thus far resection with advancement, treating the opposing muscle exactly as we did in the first case. (*c*) Moderate deviation, for which we employed the O'Connor cinch shortening coupled with recession of the opposing muscle. In each of the cases the results as shown were obtained by a single operation on the muscles of the one eye.

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A NEW TYPE OF TELESCOPIC LENS

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NEW YORK

A moderate degree of visual acuity is generally sufficient for moving about safely outdoors. Even when the visual acuity is as low as 1/20 or less a person is able to move about satisfactorily without assistance. It is, however, a matter of extreme importance to such a weak-sighted person to be able on occasion to see a particular distant or near object more distinctly.

Ophthalmologists who have been working with and prescribing the telescopic lenses which are now available have been repeatedly discouraged by the refusal of patients to wear them in spite of the visual aid received, even after rehabilitation by the new conditions arising from magnification and a narrowed field. This has been largely due to their conspicuous physical appearance and their weight. The ideal telescopic device should simulate as closely as possible in appearance the ordinary familiar eyeglass spectacle and should not be overly expensive.

To accomplish this a unit would have to be designed which would allow for a shortening in its thickness, combined with the elimination of metal tubes and parts. Such a unit would have to give the proper magnification, allow for the maximum of field and have the necessary correction for the astigmatism for oblique pencils of rays and for chromatic spherical aberration.

In the galilean system the telescope depends for its effect on an anterior converging lens and a diverging posterior lens. Hitherto these lenses were held together in a tube or holder and were separated by an air space in order to provide an intervening medium with a low index of refraction. This form of construction of necessity causes an objectionable thickness.

In an attempt to overcome this, E. Polackoff evolved the idea of a fused telescope. This was accomplished by using a strong positive and a strong negative flint lens of a high index of refraction separated by a crown glass component of a low index of refraction to which they are permanently united by welding. The research staff of the Univis Lens Company developed and made practical this lens.

Read at the meeting of the Section of Ophthalmology, New York Academy of Medicine, Feb. 17, 1936.

Figure 1 *A* shows the construction of one form of the lens and the manner in which it is mounted in the carrier lens. The telescopic unit is shown mounted for reading in a carrier lens ground to the correction for distance. Great care must be taken to insure that the optical axis of the telescopic unit is correctly adjusted. In figure 1 *B* another lens is shown with a unit mounted for distance vision.

The fused telescope is constructed in the form of a small segment or insert. The mounting is accomplished by the use of the telescopic insert in a carrier lens which is ground to the correction for distance required by the wearer. This telescopic insert may be for near or for distant vision, and the factor of distance governs its position in the carrier lens.

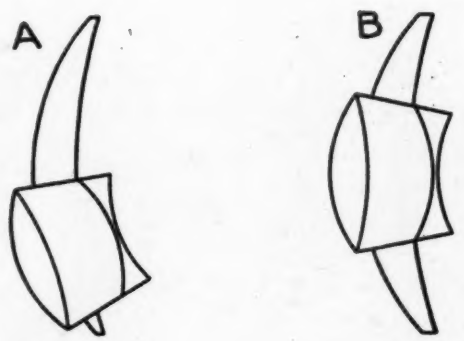

Fig. 1.—Construction of telescopic unit for near vision (*A*) and for distant vision (*B*).

The angular field of view given by one of these telescopic inserts depends on its magnification, being less in range as the magnification increases. For this reason the magnification should be kept as low as the patient's state of vision will permit. At present the fields obtained with a 20 mm. aperture with the $\times 1.5 \times 1.75$ distance units are 24 and 18 degrees, respectively. This admittedly is not high but is compensated for by the fact that the insert, being small, may be so mounted that its wearer can constantly look past it and recognize objects situated above to the right or left, though less distinctly. Patients who were unable to wear the older types of lenses state that this factor is most important for comfort. When telescopic aid for reading only is desired the insert is mounted in the lower part of the carrier lens, giving the effect of a bifocal lens. By increasing the curvature of the carrier lens the telescopic insert may be sunk still deeper, thus causing its anterior projecting surface to be less prominent.

Although fused, the telescopic insert, for the purposes of description, may be said to have three components: the objective, the eyepiece and the separating piece. Both the objective and the eyepiece are made of glass of a high index of refraction (1.74). The separating piece to which they are welded is glass of a low index of refraction (1.522). The curvature of the ocular surface of the eyepiece may be varied to accommodate different refractive errors. For reading, power (+4D., +6D., +8D., etc.) is added to the front surfaces of the objective only, so that cylindric corrections may be taken care of at the contact surface

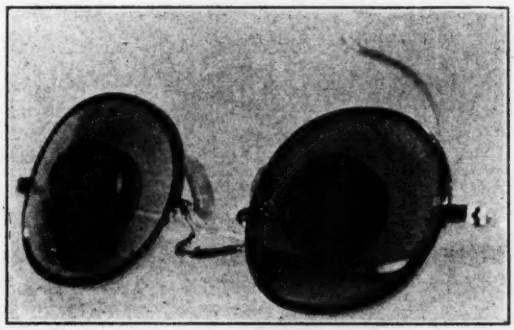

Fig. 2.—Photograph of the × 1.5 unit for distance. The entire unit is tinted with Shade 4—Softlite.

Fig. 3.—Photograph of the × 1.5 unit for near vision; the lenses are not tinted.

between the objective and the separatory component. The diameter of the objective and that of the eyepiece in the ×1.5 distance unit are 20 mm. and 16 mm., respectively. The insert used at the present time measures from 13 to 15 mm. in thickness. The older types of telescopic lenses are about twice this size. At present, only the ×1.5 lens for distance or for near vision is available.

In actual practice I have found that this type of telescopic lens is very valuable, particularly for those patients whose vision can be aided by magnification of lower power and whose visual fields are not overly contracted. It goes without saying that in cases of extreme

amblyopia in which very high magnification is required to effect slight improvement only rarely will satisfaction result from any form of magnifying device. I have also found that children adapt themselves with ease to the lower magnifications. The type of device in which the insert is used as a bifocal lens for reading has proved to be especially useful in cases of incipient cataract. With all types of devices, such as telescopes or contact lenses, it is a great mistake to allow the patient to use them untrained or uninstructed. A period of rehabilitation is necessary. Direct supervision by the physician in the office or clinic is best.

Figures 4, 5 and 6 show in diagrammatic form the manner in which a magnified image is produced by the telescopic unit in different cases. In order that the diagrams may not be too complicated by having to

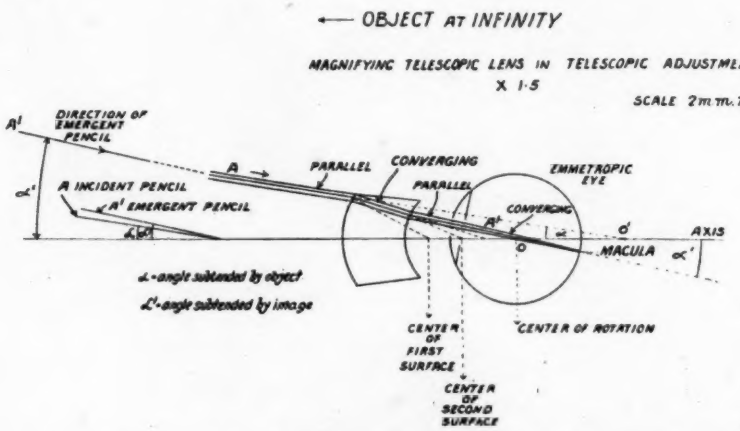

Fig. 4.—Diagram of telescopic unit producing with an emmetropic eye a magnification of × 1.5 for a distant object.

show refraction of the rays at too many internal surfaces, a simplified form of telescopic unit is shown. The curvatures and separation have been modified so that for the present purpose one can assume that refraction takes place at the front and the back surface of the unit only.

In figure 4 a telescopic unit is shown producing with an emmetropic eye a magnification of ×1.5 for a distant object. A pencil, *A*, of parallel rays from a distant extra-axial object point is shown incident on the front surface of the telescopic unit. This incident pencil *A* makes an angle α with the optic axis of the unit. After refraction by the front surface the pencil is rendered convergent and remains so until the back surface is reached. The power of the back surface is such that the pencil emerges parallel once more but making a new angle α with the optical axis. The emergent parallel pencil *A'* then enters the emme-

tropic eye and is brought to a sharp focus on the macula, forming an image of the distant extra-axial object point. The chief ray of the emergent pencil passes through O, the center of rotation of the eye, making an angle α with the optical axis. The chief ray of the incident pencil would, therefore, if produced, pass through O', the virtual image of O formed by the telescopic unit, and would cut the axis at the angle α. The magnification under which the distant object is seen is therefore given by $M = \frac{\alpha'}{\alpha}$ and in this case is $\times 1.5$.

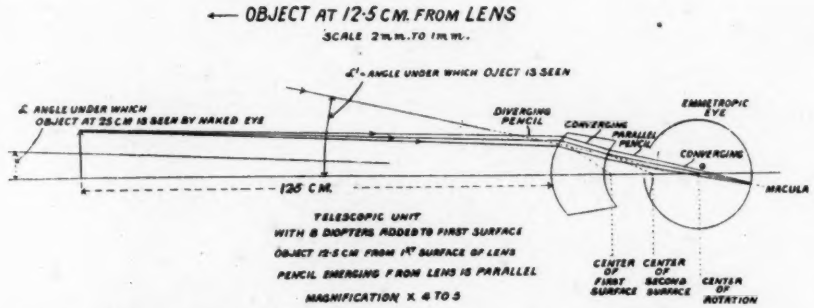
← OBJECT AT 12·5 CM. FROM LENS
SCALE 2 m.m. TO 1 m.m.
α'= ANGLE UNDER WHICH OJECT IS SEEN
α ANGLE UNDER WHICH OBJECT AT 25 CM IS SEEN BY NAKED EYE
DIVERGING PENCIL
CONVERGING
PARALLEL PENCIL
EMMETROPIC EYE
CONVERGING
MACULA
12·5 CM.
TELESCOPIC UNIT
WITH 8 DIOPTERS ADDED TO FIRST SURFACE
OBJECT 12·5 CM FROM 1ST SURFACE OF LENS
PENCIL EMERGING FROM LENS IS PARALLEL
MAGNIFICATION X 4 TO 3
CENTER OF FIRST SURFACE
CENTER OF SECOND SURFACE
CENTER OF ROTATION

Fig. 5.—Diagram of telescopic unit constructed for reading at a distance of 12.5 cm. with an emmetropic eye.

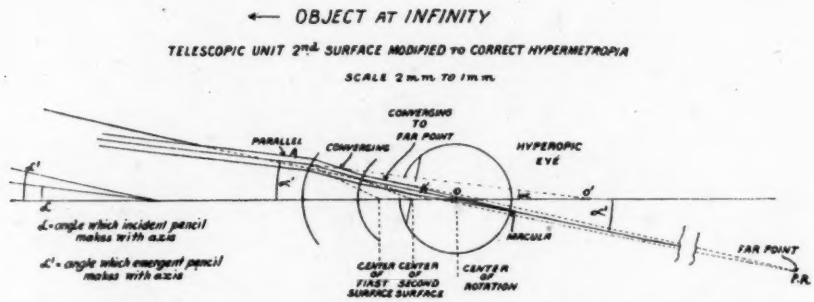

Fig. 6.—Diagram of telescopic unit for distant vision with a hyperopic eye.

Figure 5 shows a telescopic unit constructed for reading at 12.5 cm., again with an emmetropic eye. The magnification of a near object is obtained by comparing the angle under which the image is seen with the angle under which the object is seen by the naked eye at the distance of most distinct vision; this is usually taken as 10 inches, or 25 cm. In this case, therefore, there is already a magnification of $\times 2$ resulting from the fact that the unit has been constructed so as to bring to a focus an object at a distance of 12.5 cm. As the telescopic magnification is in this case also $\times 2$, the total magnification is 2×2, or $\times 4$. If the emmetropic eye accommodates, the object may be held closer, with a further increase in magnification.

In this case the incident pencil of rays from the extra-axial object point diverges, since the object is situated at a distance of 12.5 cm. The pencil is rendered convergent by the action of the front surface and emerges as a parallel pencil after refraction at the back surface of the unit. This parallel pencil is brought to a focus on the macula by the emmetropic eye. The chief ray of the emergent pencil again passes through O, the center of rotation of the eye, and defines the angle α' under which the image of the object is seen. α is the angle under which the object at a distance of 25 cm. is seen by the naked eye. The magnification obtained is again given by $M = \frac{\alpha'}{\alpha}$ and in this case is $\times 4$, without accommodation.

Figure 6 shows a telescopic unit for distance vision, with a hyperopic eye. Again a pencil, A, of parallel rays from a distant extra-axial object point is shown incident on the front surface of the telescopic unit. The chief ray of this incident pencil when produced passes through O', making an angle, α, with the optic axis. O' is the virtual image formed by the unit of O, the center of rotation of the eye. After refraction by the front surface the pencil is sharply convergent until the back surface is reached, where further refraction takes place, the convergence of the pencil being reduced to an amount depending on the degree of hyperopia to be corrected.

The power and position of this back surface are calculated so that the emergent pencil of rays A' converges and comes to a focus at $P.R.$, the far point of the hyperopic eye under consideration. This pencil is therefore brought to a sharp focus on the macula by the unaccommodated hyperopic eye. The chief ray of the pencil then makes an angle α' with the optical axis and passes through O, the center of rotation of the eye. As in the previous cases, the magnification is given by $M = \frac{\alpha'}{\alpha}$ and in this case is about $\times 1.75$.

If the eye had been myopic instead of hyperopic the illustration would have been the same as figure 6, except for the convergence of the emergent pencil of rays. Since the far surface of the myopic eye lies in front of the lens, the back surface of the lens would have been modified so as to cause divergence of the emergent pencil rays from the far point. The pencil would then again be brought to a focus on the macula without accommodation.

FURTHER OBSERVATIONS ON DETACHMENT OF THE CHOROID AFTER CATARACT EXTRACTION

C. S. O'BRIEN, M.D.
IOWA CITY

In a previous study of detachment of the choroid after extraction of cataract [1] it was discovered that separation occurred frequently during the operation or within a few minutes after delivery of the lens. In the report of that study the statement was made that, so far as could be determined, the sudden reduction of intra-ocular pressure almost invariably resulted in immediate transudation of fluid into the supra-choroidal space, with resultant detachment of the choroid at the time of operation. A report of further observations is herein offered as proof of that statement.

Ophthalmoscopic examination of the fundus was attempted immediately after cataract extraction in 140 consecutive cases in which there were no complications. The fundus was well visualized in 92 of the 140 cases, and in 86 of these detachment of the choroid was observed, an incidence of more than 93 per cent. Among the 86 cases in which detachment was seen, the lens had been extracted intracapsularly in 81 and by the extracapsular method in the 5 remaining cases, which is evidence that the method of extraction apparently is not a determining factor in the production of choroidal detachment.

In 54 cases the fundus was invisible or could not be properly studied because of cortical remnants, blood or air in the anterior chamber, haziness of the cornea or other less frequent obstructions to vision.

All the detachments were more or less flat, as one would expect, and had a characteristic appearance. The border of the detached area appeared as a dark, gently curved, elevated line with the convexity directed toward the nerve head. At this border the retinal vessels arched forward and accentuated the appearance of elevation. Peripheral to the border, over the area of detachment, the fundus had a light,

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From the Department of Ophthalmology, State University of Iowa College of Medicine.

Read at the meeting of the American Ophthalmological Society, Hot Springs, Va., June 3, 1936.

1. O'Brien, C. S.: Detachment of the Choroid After Cataract Extraction, Arch. Ophth. **14**:527 (Oct.) 1935.

translucent appearance. It has been suggested that the detachment is somewhat similar in appearance to that of a lens which is dislocated into the vitreous.

The location of the detachment varied, but in 75 cases it was in the inferior, the inferotemporal or the inferonasal part of the fundus, usually well toward the periphery. In 4 cases the detachment was in the inferotemporal and inferonasal portions, with a normal intervening area; in 4 it was in both the inferior and the superior portion, and in the remaining 2 cases it was situated in the temporal part of the fundus. It must be recorded that visualization of the extreme upper periphery of the eyeground is difficult after cataract extraction, and observations were not often satisfactory; consequently more detachments may have been present in this area.

The size of the detachments was variable and in many cases was seen to increase during the period of observation. As a rule the detached area was situated in the equatorial and more peripheral regions and appeared to occupy from 90 to 120 degrees of the circumference at the ora serrata. A large area of detachment, occupying approximately one half of the fundus and reaching almost to the nerve head, was observed in 16 cases.

The choroid always reattached, with healing and closure of the corneal wound, and vision was unaffected.

CONCLUSIONS

Detachment of the choroid occurs with regularity during or immediately after cataract extraction. In 140 consecutive cases in which there were no complications the fundus was visible in 92, and in 86 of these the choroid was observed to be detached, an incidence of more than 93 per cent.

PREPARATION OF ORBITS OF CADAVERS FOR DISSECTION AND OPERATION

OSCAR V. BATSON, M.D.
PHILADELPHIA

The drying out of tissues, especially the dehydration of the humors of the globe, seriously impairs the use of embalmed cadaveric material for both orbital dissection and ophthalmic operation. In preparing the material for the course in ophthalmic operations on cadavers in the Graduate School of Medicine of the University of Pennsylvania various methods have been used to overcome these difficulties. Of course the simplest method is an injection of water into the globe itself and into the tissues of the orbit with an ordinary small hypodermic syringe and hypodermic needle. This procedure, while relatively satisfactory for restoring the contour and tension of the globe to approximately normal, has this disadvantage: The water leaks out rapidly and has to be replaced. Since all the material used by my associates and me is embalmed without the use of solution of formaldehyde,[1] the addition of any water-soluble fluid restores suppleness. It seemed that the use of gelatin would afford a means of rather permanently restoring the globe to its proper size. The difficulty with gelatin masses, as first prepared, was found to be their rigidity. This has been taken care of by using a glycerin jelly of the following formula:

	Gm. or Cc.
Gelatin (Difco, bacteriologic)	40
Water	200
Glycerin	760

This material melts readily and can be injected with an ordinary 10 cc. syringe and a no. 20 hypodermic needle. Care is taken to penetrate the globe outside of the cornea, and the material is injected until the globe seems to be sufficiently tense. The needle is withdrawn and the excess gelatin allowed to run back through the puncture. Since injection of too little material is better than introduction of too much, this procedure must be followed. On congealing, the globe has a contour more or less resembling the normal, depending on whether or not the material was introduced into the anterior chamber. The tension roughly

From the Graduate School of Medicine, University of Pennsylvania.

1. Batson, O. V.: Cadavers with Flexible Joints, Science **60**:336, 1924; Preparing Cadavera for Endoscopy, Ann. Otol., Rhin. & Laryng. **45**:58 (March) 1936.

approaches that of the normal eye. Care should be exercised that the injection is confined to the globe, as otherwise the mobility of the globe is limited.[2]

For restoring fluid to the lids and the orbital tissues the following mixture is used:

	Parts
Glycerin	200
Water	50

This produces a suppleness and fulness of the part, which also persists for several weeks. The purpose of the water is to lower the viscosity of the glycerin so that it may be readily injected into the areolar tissues.

This year my associates and I have also used this method for preparing the orbits used for dissection and have had satisfactory results. The materials here recommended keep well, without the growth of mold. We have kept some of the gelatin mass for three years and have noted no significant difference between the old mass and the masses freshly prepared.

2. Dr. G. F. J. Kelly, in charge of the course in ophthalmic operations, has offered valuable criticisms in arriving at the present procedure.

CATARACT EXTRACTION THROUGH A VERTICAL CONJUNCTIVAL SLIT

PRELIMINARY REPORT

WALTER MOEHLE, M.D.
BROOKLYN

Subconjunctival extraction of the lens was advocated and practiced during the nineteenth century. Apparently the first references were by Alexander in 1825, Desmarres in 1851, von Hasner in 1873 and Pansier and Vacker in 1899. Czermak [1] later recommended the use of the vertical conjunctival slit in cases in which loss of vitreous is threatened, either during extraction of cataract, owing to dementia, excitement, dislocation of the lens into the anterior chamber or overripening, or after the operation, because of gaping of the wound due to great restlessness, violent paroxysm of coughing, etc.

Dimmer [2] in 1907 modified Czermak's operation and Cluckie [3] in 1909 described a subconjunctival method of extraction similar to that described by Haab.[4] In 1910 Bajardi [5] advocated a procedure essentially similar to that of Cluckie.

My method differs from the methods of Czermak, Dimmer, Cluckie and Bajardi in that a vertical incision is made above, extending into the cul-de-sac, and the lens is expressed subconjunctivally through a slit in the undermined conjunctiva. In fact, all the steps of the operation relative to the extracting of the lens are accomplished through this vertical incision in the conjunctiva. I submit this description of an apparently satisfactory technic, which will doubtless undergo such modification as experience dictates.

The preoperative preparation consists of a general physical examination, including all the laboratory tests of the blood chemistry and

1. Czermak: Ueber subkonjunctivale Extraktion, Ber. ü. d. Versamml. d. ophth. Gesellsch., 1903, p. 115; Subkonjunctivale Extraktion mit Bindehauttasche, Klin. Monatsbl. f. Augenh. **41**:497 (Aug.) 1903.

2. Dimmer, F.: Eine subkonjunctivale Methode der Starextraktion, Ber. ü. d. Versamml. d. ophth. Gesellsch. **34**:218, 1907.

3. Cluckie, N. G.: A Corneo-Conjunctival Bridge: A New Method of Cataract Extraction, Lancet **2**:1073, 1909.

4. Haab, O.: Atlas and Epitome of Operative Ophthalmology, translated by G. E. de Schweinitz, Philadelphia, W. B. Saunders Co., 1905, p. 158.

5. Bajardi, P.: Sulla estrazione sottocongiuntivale della cataratta, Boll. d. r. Accad. med. di Genova **25**:32, 1910.

examination of the sinuses, teeth and tonsils. A routine Wassermann test of the blood and urinalysis are carried out. A check-up on the condition of the lacrimal sac and conjunctival smears are made. I prefer using Bell's [6] method of instilling a few drops of a 1 per cent solution of silver nitrate in the eye to be operated on, one hour before operation. For producing akinesia I use the method of blocking the facial nerve, as described by O'Brien,[7] or the Van Lint [8] injection into the lids. Anesthesia is obtained by instillation of a 2 per cent solution of butyn into the conjunctival sac every two minutes until five doses have been given.

TECHNIC OF OPERATION

First Step.—Before beginning the operation a consideration of the blood supply of the conjunctiva in the area of the field of operation is advisable. In this manner it is possible to avoid bleeding by starting the incision between the conjunctival vessels.

After akinesia is complete the lids are held apart with a lid speculum. The patient is directed to look down and the conjunctiva is grasped with a fine forceps about 5 mm. from the upper limbus, in the vertical meridian. With blunt iris scissors the conjunctiva is slit vertically. The incision is then carried downward, terminating about 1.5 mm. from the limbus. This allows a small retained flap of conjunctiva, tending to prevent gaping of the incision after the operation is completed. From the starting point the incision is then continued upward to the cul-de-sac. With the iris scissors the conjunctiva is undermined well down to the central horizontal meridian of the cornea in both the nasal and the temporal quadrant and up in the region of the fornix. This gives a vertical conjunctival incision about 20 mm. long, with two large pockets of thoroughly undermined conjunctiva.

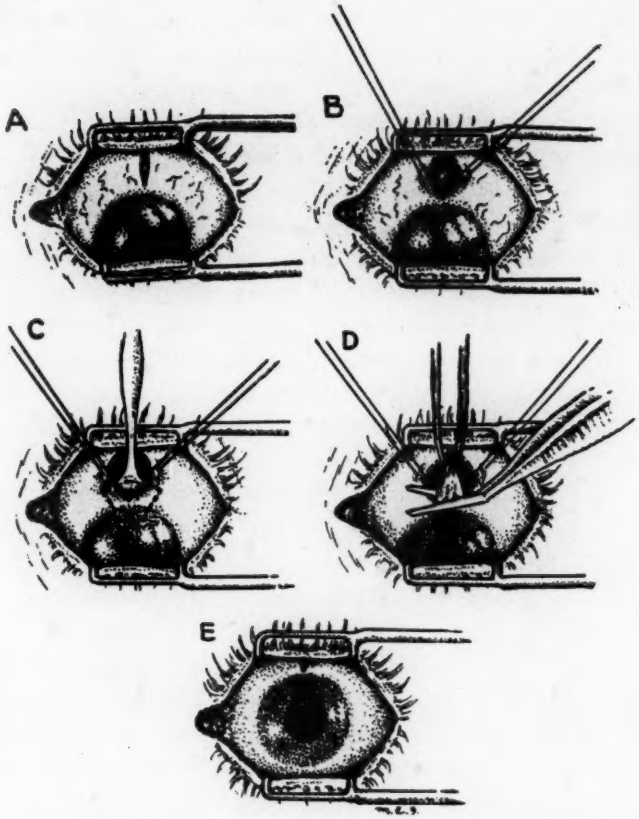
Second Step.—Silk sutures are placed near the edge of the loose incised conjunctiva, about 5 or 6 mm. from the limbus, one on each side as a loop. These serve as a means of making upward traction on the lax conjunctiva.

Third Step.—The assistant is then directed to raise the edges of the wound by making upward and lateral traction with the loop sutures. The relaxed fornix also permits the elevated edges to be drawn downward in the direction of the limbus. This prevents any drag on the area of the corneal section and also provides more space for operating. With a keratome at the upper limbus and with the blade under the elevated conjunctiva, an incision is made. This should be made as

6. Bell, G. H.: A New Method of Preventing Post-Operative Intraocular Infection, Arch. Ophth. **52**:436, 1923.

7. O'Brien, C. S.: Local Anesthesia, Arch. Ophth. **12**:240 (Aug.) 1934.

8. Van Lint: Ann. d'ocul. **151**:420, 1914; Arch. d'opht. **43**:714, 1926.



A, the lids are held open with a lid speculum, and the eyeball is depressed. A vertical conjunctival slit 1.5 mm. is made from the upper limbus, extending upward for 20 mm. *B*, the conjunctiva is undermined on each side as far as the horizontal central meridian. A silk loop suture is placed in each flap 5 or 6 mm. from the upper limbus. This serves as a means of opening the slit by upward traction on the lax conjunctiva. Through this separated incision iridectomy is easily done. This method also allows sufficient room for expressing the lens and irrigating the chamber. *C*, with the loosened conjunctiva kept elevated by means of the loop sutures, the section is made with a keratome at the upper limbus. The blade is kept under the conjunctiva. Further enlarging of the wound is done with scissors. *D*, the iris is grasped with an iris forceps, drawn throughout the corneal section and excised. The edges of the corneal flap are held up and apart by means of the loop sutures. The lens is then expressed by pressure at the lower part of the cornea and counterpressure on the sclera above the region of the corneal section between the separated conjunctival flap. The chamber is readily irrigated; the pillars of the iris are reposited, and the loops are removed from the conjunctiva. *E*, the conjunctival slit edges lie flat and come together, allowing a slight separation between the edges. No sutures are necessary, as proximity of the edges follows, with rapid healing of the wound.

large as possible by carrying the tip of the keratome well down in the chamber. On withdrawal of the keratome the cutting edge is swept from the nasal to the temporal side, cutting as it is withdrawn. The incision is further enlarged with a snip or two with de Wecker scissors,[9] one blade in the anterior chamber between the iris and cornea and the upper blade under the undermined conjunctiva.

Fourth Step.—With the edges of the conjunctiva still elevated, iridectomy is done in the usual manner, capsulotomy performed and the lens expressed by pressure at the lower part of the cornea and counterpressure over the sclera above the wound between the spread edges of the elevated conjunctiva. During this procedure the patient is directed to look down, and the assistant constantly elevates the conjunctival edges with the loop sutures. The pillars of the iris are then reposited with a spatula by carrying the spatula under the undermined conjunctiva through the corneal section. Any cortical material remaining can be readily washed out of the chamber with an irrigator.

Fifth Step.—The major part of the operation having been completed, the two sutures in the conjunctiva are withdrawn. The conjunctiva immediately flattens down and the edges of the incision can be brought together as near as possible with a small forceps. No sutures are necessary to facilitate healing of the wound, though the technic does not contraindicate their use. Within twenty-four hours the wound and conjunctiva are well agglutinated, and the chamber is generally restored. A binocular dressing is then applied. No subsequent dressing is required on the eye on which operation was not performed.

COMMENT

I have presented this method of extracting the lens because I believe that it embodies features which are desirable. First of all, the anatomic conjunctival supply of blood to the region of the corneal section is retained, because the incision is made parallel to the course of the vessels, thus assuring maximum nutrition and also avoiding unnecessary hemorrhage. This method also facilitates the making of the corneal section with a keratome, with subsequent enlargement of the section with scissors subconjunctivally. The vertical slit renders the iris and capsule accessible and does not interfere with the delivery of the lens. Last, a point which I feel is important, no conjunctival suture is required, since the undermined conjunctiva immediately lies smooth and flat, with the edges of the incised wound in close approximation. However, if desired, a suture may be inserted, closing the conjunctival incision.

15 Schermerhorn Street.

9. These scissors should have one blunt-pointed blade. This is the blade which enters the chamber.

ADENOCARCINOMA OF THE ORBIT

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Neoplastic tumors that occur within the orbit can be classified on the basis of origin into three types as follows: (1) a primary tumor, one that originates within the orbit from tissue normal to that region or from bits of misplaced embryonic remnants; (2) a metastatic tumor, the original cells of which are brought to the orbit by the blood or lymph stream from a primary growth in a structure elsewhere in the body, and (3) a tumor resulting from invasion of the orbit by direct extension through the orbital walls or orifices by a neoplastic process in a contiguous region. This classification is only of clinical significance, for these tumors include tissue representative of a large proportion of the various neoplastic diseases of the body. Carcinoma and sarcoma representative of all types of this classification occur within the orbit with relative frequency, while highly differentiated malignant growths, with histopathologic structures characteristic of the place of origin, are infrequent.

Adenocarcinoma is a well differentiated neoplasm of epiblastic origin that shows by its histopathologic characteristics that it originated within glandular tissue from certain secretory cells and that maintains its characteristics through various grades or degrees of malignancy or rates of growth. It occurs in practically all parts of the body where glandular tissue is found, and as it spreads by direct extension through contiguous tissues as well as by metastasis, it is to be considered one of the most hazardous types of malignant conditions. However, metastasis to the orbit is rare. Only a few cases of proved adenocarcinoma of the orbit of all types have been reported, and many features pertaining to the development and clinical reaction to treatment are not well understood. In the few descriptions that can be found in the sparse literature on the subject such a tumor has been reported as a tumor of the lacrimal gland, and in fully 85 per cent of the cases, as of the mixed tumor type.

In July 1930 five cases of primary adenocarcinoma of the orbit were reported by Broders and me [1] under the title "Adenocarcinoma of the Lacrimal Gland: So-Called Mixed Tumor." We noted in that report

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Read before the Section on Ophthalmology at the Eighty-Seventh Annual Session of the American Medical Association, Kansas City, Mo., May 13, 1936.

1. Benedict, W. L., and Broders, A. C.: Adenocarcinoma of the Lacrimal Gland: So-Called Mixed Tumor, Am. J. Ophth. **13**:585-595 (July) 1930.

that the principal lobes of the lacrimal gland often are not involved in the growth, and we suggested that such a tumor may arise from the accessory lacrimal glands, which extend along the fascia of the orbit from the lacrimal gland toward the nasal side; also we said that the tumor may arise from bits of epiblastic tissue in some other part of the orbit, the tumor giving evidence of more or less differentiation toward gland cells. We described the histopathologic characteristics of the tumor. It is made up of round, oval, spindle and stellate cells intermingled with stellate and mucous connective tissue cells, of stellate and spindle cartilage cells and of a structure conforming somewhat to that of the lacrimal gland. The tumor shows a low grade of malignancy. Since that report was published two of the patients have died; two are well, with no recurrences, and one has not been heard from since 1933. The last-mentioned patient had had no recurrence for more than five years.

Since the publication of our paper reports of other cases have appeared with comments by the authors on the origin of the tumors described. Santori [2] reviewed the cases reported and added one which he had observed. He remarked that in many of the first cases of tumor of the lacrimal gland which were reported no histologic proof was obtained and the growth may well have originated from other surrounding tissue. When these cases are excluded, it appears that tumor of the lacrimal gland itself is exceedingly rare. Santori's patient was a woman of 60 who had a tumor situated within the upper lid, above the outer canthus. Histologically, it was a small alveolar adenocarcinoma. A year later the patient died of pulmonary disease. There had been no recurrence. Santori stated that adenocarcinoma of the lacrimal gland develops in the fibromuscular planes of the upper lid. It grows slowly and usually does not invade the eyeball. When excised locally it is likely to recur. Natale [3] operated on a man 46 years of age for a primary tumor of the left orbit which proved on histologic study to be an adenocarcinoma instead of a fibroma or fibrosarcoma, as had been expected. The author expressed the belief that the tumor may have originated primarily from embryonic epithelial remnants within the orbital cavity and that subsequently carcinomatous degeneration had taken place.

Freyberg [4] reported a case in which a neoplasm of the right orbit was known to have existed twenty-five years before the death of the patient. Nine years after the clinical onset of the tumor the displaced

2. Santori, G.: Adenocarcinoma primitivo della ghiandola lacrimale, Ann. di ottal. e clin. ocul. **58**:439-447 (May-June) 1930.

3. Natale, A.: Adenocarcinoma primitivo de órbita, Rev. de especialid. **6**:954-961 (Oct.) 1931.

4. Freyberg, R. H.: Adenocarcinoma of the Lacrimal Gland, with Case Report, Am. J. Ophth. **15**:417-422 (May) 1932.

eyeball was removed. Soon there was noticed in the right orbit a mass which increased in size slowly for seven years and then suddenly began to grow rapidly. Sixteen years after the original onset exenteration of the right orbit and the involved nasal sinuses was carried out. Recurrence followed, and a second exenteration was performed twenty-five years after the tumor was first known to be present. At necropsy it was found that the right orbit was completely destroyed, the roof was absent and the brain was exposed in an area measuring 3.5 by 4 cm. Neoplastic tissue extended along the right optic nerve, and the pituitary gland was displaced to the left by a pyramidal mass of neoplastic tissue which occupied the position of the right cavernous sinus. The capsule of the pituitary gland was invaded on the right by the neoplasm. No distant metastatic growths were found. Microscopic examination of the tissue removed at necropsy and at exenteration disclosed the presence of adenocarcinoma of the lacrimal gland.

Among the instructive reports published within the past five years were those of Penman,[5] Michail,[6] Poos,[7] Hardy and Hardy,[8] and Davis,[9] describing primary and metastatic orbital tumors, and many other reports dealing with metastatic carcinoma of the eyeball.

Birch-Hirschfeld[10] commented on the difficulties encountered in attempting to classify a tumor of the lacrimal gland according to the anatomic and clinical signs, because it frequently is not easy to determine whether a tumor is a primary one originating in the lacrimal gland. He expressed his agreement with Berlin that

> we have every reason to be extremely cautious in making a diagnosis of tumor of the lacrimal gland since tumors in the neighborhood of the lacrimal gland may conform wholly with the clinical and anatomical picture of a lacrimal gland tumor, and even in operative cases and those that have been carefully examined anatomically it is not always possible to discern the origin of the tumors. Thus, naturally, many cases have been designated as lacrimal gland tumors which had nothing to do with the gland itself, while on the other hand many a case of lacrimal gland tumor has been described by the author under the general classification of an orbital tumor.

5. Penman, G. G.: Tumour of the Lacrymal Gland, Proc. Roy. Soc. Med. **26**:461, 1932.

6. Michail, D.: Metastatic Carcinoma of the Orbit, Brit. J. Ophth. **16**:537-545 (Sept.) 1932.

7. Poos, F.: Ueber die Beziehungen zwischen den pathologisch-anatomischen Veränderungen und klinischen Erscheinungen bei Ca-Metastasen in den Sehnerven- und Okulomotoriusstamm, Klin. Monatsbl. f. Augenh. **92**:585-592 (May) 1934.

8. Hardy, G., and Hardy, W. F.: Preliminary Report on Orbital Tumors, Am. J. Ophth. **17**:18-21 (Jan.) 1934.

9. Davis, W. T.: Metastatic Carcinoma of the Optic Disk, with Report of a Case, Arch. Ophth. **8**:226-237 (Aug.) 1932.

10. Birch-Hirschfeld: Zur Kenntnis der Mischtumoren der Tränendrüse, Arch. f. Ophth. **90**:110-128, 1915.

It is evident, therefore, that primary adenocarcinoma of the orbit does not always arise from the lacrimal gland.

This report is based on a study of twenty-seven cases of proved adenocarcinoma of the orbit encountered in twenty years in which the examination was made at the Mayo Clinic. In twenty-five of the cases operation was performed, and microscopic study of the tumor was carried out at the clinic. In the other two the patient was examined at the clinic but was operated on elsewhere, and the report on the histopathologic characteristics was received by letter. According to the classification that has been mentioned, twenty-two of the tumors were of the first type, that is, they were primary in the orbit, and five were of the third type, that is, they reached the orbit by direct invasion. No cases of metastatic tumor of the orbit were included in this report.

Metastatic adenocarcinoma of the orbit is seen less frequently than tumors of the other types. Burch,[11] in 1932, found reports of only twenty-five instances of metastatic orbital tumor, in the majority of which the tumor was secondary to carcinoma of the breast. He found reports of one hundred and twenty-five cases of metastatic intra-ocular tumor. In the period of twenty years covered by the present report twelve cases of orbital or intra-ocular tumor in which metastatic adenocarcinoma involved other parts of the body than the orbit or the eyeball were encountered at the clinic. In two of the twelve cases there was a tumor behind the eyeball, and biopsy specimens taken from other parts of the body disclosed adenocarcinoma metastatic from a growth in the breast. The orbital tumor in these two cases was not removed, for it appeared late in the course of the disease. Ten of the twelve patients had an intra-ocular tumor and generalized metastasis from adenocarcinoma primary elsewhere than in the orbit or the globe. One eye was removed from each of two of the ten patients, and examination disclosed metastatic adenocarcinoma of the choroid. The other eight of the ten patients, two of whom had bilateral intra-ocular tumors, had generalized metastasis. This metastasis was from a proved primary adenocarcinoma of the breast in seven cases and from a proved primary adenocarcinoma of the thyroid in one case. Because the affected eye was not removed in any of these eight cases, there was no histologic proof that the tumor was an adenocarcinoma, although the presumption that it was is justified on clinical grounds.

To return to the real subject of my present report, only cases of proved adenocarcinoma of the orbit outside the eyeball are included in this report. Cases 5, 9, 10, 11 and 16 have been reported previously.[1]

11. Burch, F. E.: Orbital Metastases from Malignant Tumors of the Suprarenal Gland, Arch. Ophth. **7**:418-433 (March) 1932.

In the group of twenty-two cases in which the tumor was primary in the orbit there were thirteen instances of mixed tumor (table 1) and six of alveolar tumor (table 2). One growth was in a dermoid cyst (table 3) and two were not classified (table 3) A comparison of the mixed tumors with tumors of the alveolar type indicates that alveolar tumors carry a higher degree of malignancy. Consultation of tables 1 and 2 will allow a comparison to be made between cases of mixed tumor and those of tumor of the alveolar type. Attention is directed particularly to the average age of the patient at the onset of the disease, the average

TABLE 1.—*Primary Adenocarcinoma of the Orbit, Mixed Tumor Type* *

Case	Sex	Orbit	Age at Onset, Yrs.	Duration of Disease Before First Operation		Period of Survival After Last Operation		Total Duration of Disease		Condition in January 1936	Grade of Malignancy	Situation in Orbit
				Yrs.	Mos.	Yrs.	Mos.	Yrs.	Mos.			
1	M	R	63	30	..	2	..	32	..	?	1	Superior temporal
2	F	R	37	1	..	1	6	2	6	Living	1	Superior temporal
3	F	R	54	..	10	1	5	2	3	Living	1	Superior temporal
4	F	R	53	5	..	2	..	7	..	?	1	Lateral rim
5	F	L	28	5	..	6	3	11	3	Living	1	Superior temporal
6	M	R	65	2	..	1	2	3	2	Dead	1	Superior temporal
7	M	L	56	5	..	6	2	6	7	Dead	1	Superior temporal
8	M	L	39	8	..	1	..	15	7	Dead	2	Superior temporal
9	F	L	22	3	..	7	..	10	..	Living	2	Posterior third
10	F	R	32	3	..	..	5	13	5	Dead	2	Superior temporal
11	M	R	31	3	..	9	..	14	..	?	2	Lower temporal
12	F	R	49	..	5	..	6	..	11	Living	2	Superior temporal
13	F	L	51	..	9	1	3	2	..	Living	2	Posterior third

* Summary: There were five men and eight women. The right orbit was involved in eight cases and the left in five. The average age at the time of onset was 44.6 years. The average duration of the disease before the first operation was five and one-half years. The average duration of life after the last operation was three years. The average total duration of the disease was nine and one-fifth years.

duration of the disease before the first operation, the average duration of life after the last operation and the average total duration of the disease. According to Broders' method of classification by grading malignancy, seven of the mixed tumors were of grade 1 and six of grade 2. Of tumors of the alveolar type, two were of grade 1, two of grade 2 and two of grade 3. The situations of the tumor within the orbit were comparable for the two types. In the cases of tumor of the mixed type the growth was situated in the superior temporal region of the orbit in nine cases, on the lateral rim in one case, in the lower temporal quadrant in one case and in the posterior portion of the orbit in two cases. In the cases of tumor of the alveolar type the growth

was situated in the superior temporal region in three cases, in the lower temporal region in two cases and in the posterior portion of the orbit in one case.

It was impossible to determine in all cases, either at operation or by histologic examination, whether the primary mixed or alveolar tumor was primary in the lacrimal gland or came from epiblastic or glandular

TABLE 2.—*Primary Adenocarcinoma of the Orbit, Alveolar Type**

Case	Sex	Orbit	Age at Onset, Yrs.	Duration of Disease Before First Operation		Period of Survival After Last Operation		Total Duration of Disease		Condition in January 1936	Grade of Malignancy	Situation in Orbit
				Yrs.	Mos.	Yrs.	Mos.	Yrs.	Mos.			
14	M	L	28	2	..	3	..	5	..	Dead	1	Lower temporal
15	F	R	26	2	..	..	4	2	4	Dead	1	Lower temporal
16	F	R	39	..	7	2	11	3	6	Dead	2	Superior temporal
17	M	L	41	..	9	2	4	3	1	Living	2	Superior temporal
18	M	R	49	..	7	..	11	1	6	Dead	3	Posterior third
19	M	R	63	..	3	..	6	..	9	Living	3	Superior temporal

* Summary: There were four men and two women. The right orbit was involved in four cases and the left in two. The average age at the time of onset was 41 years. The average duration of the disease before the first operation was one year. The average duration of life after the last operation was one and three-fifths years. The average total duration of the disease was two and three-fifths years.

TABLE 3.—*Primary Adenocarcinoma of the Orbit, Miscellaneous Types**

Case	Sex	Orbit	Age at Onset, Yrs.	Duration of Disease Before First Operation		Period of Survival After Last Operation		Total Duration of Disease		Condition in January 1936	Grade of Malignancy	Type of Tumor	Situation in Orbit
				Yrs.	Mos.	Yrs.	Mos.	Yrs.	Mos.				
20	F	L	15	5	..	1	10	6	10	Living	2	Dermoid cyst	Superior temporal
21	M	L	39	4	..	?	..	4	..	Dead	?	?	Superior temporal
22	F	R	16	2	..	?	..	5	..	?	?	?	Superior temporal

* Summary: There were two females and one male. The right orbit was involved in one case and the left in two cases. The average age at the time of onset was 23.3 years. The average duration of the disease before the first operation was three and three-fifths years. The average total duration of the disease was five and one-fifth years.

structure elsewhere in the orbit. At operation multiple tumors not infrequently appeared, so that it was impossible to determine whether direct contiguity existed. In some cases the lacrimal gland was found to be uninvolved in the tumor. It is evident, therefore, that in a certain but undetermined percentage of cases the primary adenocarcinoma of the orbit originated outside the lacrimal gland. In some cases the tumor was firm, encapsulated and easily removed. In others it was widespread,

infiltrating adjacent tissues, unencapsulated and apparently composed of multiple lobes. As a rule the latter type was considered as having a higher degree of malignancy. All recurrent tumors were of the latter type.

Adenocarcinoma of the antrum, the sinuses, the pterygoid space or the parotid region is fairly common. Direct invasion of the orbit (table 4) through the floor from a tumor situated in the antrum and in the pterygoid fossa was found in two cases and invasion through the nasal wall from the ethmoid region in three cases. In four of the five cases the tumor was discovered and operated on or treated otherwise before invasion of the orbit occurred. Recurrence in these regions is not uncommon, and invasion of the orbit usually necessitates exenteration. It is interesting to note that although adenocarcinoma is considered to

TABLE 4.—*Adenocarcinoma of the Orbit, Secondary by Invasion*

Case	Age, Yrs.	Sex	Orbit	Where Primary	Duration of Disease Before Operation: Primary	Duration of Disease Before Operation: Secondary	Comment
23	39	M	R	Right antrum	3 yrs.	5 mos.	Living 4 months after operation; no recurrence
24	65	M	L	Left ethmoid	2 yrs.	?	Died 5 years after operation
25	51	M	R	Right ethmoid	?	?	Living 4 months after operation; extensive pansinus involvement; no operation
26	75	F	L	Left antrum	?	2 mos.	Living 7 months after operation; grade 1 adenocarcinoma
27	14	M	R	Right ethmoid	..	3 mos.	Living 4 years after operation; no recent note

metastasize freely, in none of these twenty-seven cases of adenocarcinoma primary about the orbit and sinuses was generalized metastasis found. When the tumor recurs after operation, it seems to take on an added degree of malignancy.

CONCLUSIONS

1. Study of twenty-seven cases of adenocarcinoma of the orbit disclosed that primary tumor is more frequent than secondary tumor, in the proportion of 22:5.

2. In the cases of primary tumor the ratio of the incidence of mixed tumor to that of tumor of the alveolar type is about 2:1.

3. The proportion of cases in which primary adenocarcinoma of the orbit arises in the lacrimal gland is not known, but since in many instances adenocarcinoma of the orbit is known not to arise from the lacrimal gland, the statement that a tumor did so arise should not be made unless the fact can be definitely proved.

4. The alveolar type of orbital carcinoma develops earlier in life, progresses more rapidly and is more malignant than the orbital carcinoma of mixed type.

ABSTRACT OF DISCUSSION

DR. MARTIN COHEN, New York: A tumor which appears within the orbital cavity may arise in any of the three ways mentioned by Dr. Benedict. I have encountered only one adenocarcinoma within the orbital cavity which could be designated as having arisen from the main or accessory lacrimal gland.

I recently observed a patient of Dr. Bullwinkel's who had a metastatic adenocarcinoma within the orbital cavity and who was suffering from a condition of the prostate gland clinically diagnosed as carcinoma. The morphologic characteristics of the metastatic lesion within the orbit suggested strongly that the growth was primary in the prostate gland, although no biopsy of the prostatic tumor has been made.

I was surprised to learn that Dr. Benedict was able to collect reports of so many cases of mixed tumor of the orbital cavity. Such a tumor morphologically resembles the so-called mixed tumor of the parotid gland. It is rarely present within the orbit and is often considered to be derived from an ectopic mass of parotid tissue. Ewing made no specific mention of orbital mixed tumor in his textbook. In Kaufmann's textbook on pathology there is no mention specifically of these tumors. Verhoeff has observed only four instances among more than two hundred thousand admissions to the Massachusetts Eye Infirmary. Birch-Hirschfeld, who has had a large experience, reported only one case of mixed tumor of the orbit in which he was positive of the diagnosis. A year ago Last published a report of a case of mixed tumor (Last, M. A.: Mixed Tumor of the Orbit of the Salivary Gland Type, Arch. Ophth. **13**: 812 [May] 1935).

I should like to emphasize the fact, already mentioned by Dr. Benedict, that one should be cautious about designating a growth as a mixed tumor unless it definitely shows spindle elements, mucoid elements, cartilage and solid or alveolar structures. In any adenocarcinoma the morphologic characteristics may be different in various parts of the growth merely in consequence of different degrees of anaplasia.

The first slide that I show is a section of a tumor of the lacrimal gland which reveals the glandular structure to be slightly hypertrophied; it also shows two cells of anaplastic and differentiated variation. The carcinomatous cells show mitotic figures.

The second slide is of a tumor of the lid of three months' duration. This is the orbital picture and definitely shows the glandular arrangement and carcinoma.

The third slide is of a tumor of the nose which extended into the orbit. It is a photograph of the orbital tissue showing definite malignancy of epithelial cells and the stroma infiltrated with carcinoma.

The fourth slide is of a tumor of the prostate gland in the case I have just mentioned. This is the orbital tumor. It was slightly adherent to the outer and upper portion of the orbital cavity and was nodulated, globular and thickened. It was removed from the orbital wall. The fifth slide is a low power photomicrograph of this growth, showing the carcinoma and muscle tissue, a picture which is significant, as several

pathologists have claimed, of a prostatic growth. The sixth slide is a high power view, showing the carcinoma and the spaces filled with epithelial cells.

Dr. Walter E. Camp, Minneapolis: All types of epithelial tumor of the orbit are rare. This series of twenty-seven cases of adenocarcinoma by Dr. Benedict is the largest yet reported. On an anatomic and clinical basis one would expect a greater percentage of these tumors to occur by extension from surrounding structures, such as the eyelids, sinuses and epibulbar structures. In Dr. Benedict's series the ratio of the incidence of primary to that of secondary tumor was about 4:1. There was no case of metastatic epithelial tumor.

In 1931 Burch reported a case of a malignant tumor of the orbit metastatic from the adrenal gland and thoroughly reviewed the literature on metastatic orbital tumor. He found reports of only twenty-five cases, and in the majority of cases the tumor had developed from a carcinoma of the breast. Intra-ocular metastatic carcinoma is five times more frequent than orbital metastatic carcinoma.

In a series of five cases of orbital tumor observed at the University of Minnesota, there were two cases of primary adenocarcinoma of the orbit. The first slide that I show is a section of the tumor from a woman about 45 and shows a typical arrangement of the glandular tissue and the nests of epithelial cells derived from glandular tissue.

The second slide is of a typical adenocarcinoma, showing little glandular tissue in this section but more in others. Both of the patients were operated on three years ago, and there has been no recurrence.

The third slide is presented because it is not of an epithelial tumor. It shows a benign meningioma from a child 2½ years of age who was operated on three months ago. There has been no recurrence. This is an unusual way for a tumor to reach the orbit.

The fourth slide is presented through the courtesy of Dr. Burch, who reported on the case, of one metastatic epithelial tumor arising in the cortex of the adrenal gland, before the Section on Ophthalmology in 1931. The fifth slide is a section showing the optic nerve completely surrounded by the epithelial tumor. The sixth slide is a photomicrograph of a section of the tumor of the adrenal gland, showing the large epithelial tumor cells. The next slide shows the orbital mass seen in one of the preceding specimens.

The origin of primary adenocarcinoma of the orbit is often difficult to determine. I believe that in the majority of cases the tumor arises from the lacrimal gland. However, as Dr. Benedict has emphasized, a tumor should not be so classified unless it is definitely proved to originate in the glandular tissue.

Dr. Arnold Knapp, New York: I wish to mention an unusual extension of a primary adenocarcinoma of the orbit. I have in mind the case of a woman with a tumor that was said by Dr. James Ewing to be an adenocarcinoma. The entire orbit was filled with neoplastic tissue, with involvement of all the nerves. At operation the orbit was exenterated. Microscopic examination showed the curious reactive connective tissue proliferation that one notes in scirrhous cancer of the breast. After exenteration of the orbit other nerve lesions and symptoms of intracranial involvement developed, and the patient died of tumor of the brain.

CHOROIDAL CHORIONEPITHELIOMA SECONDARY TO TERATOMA OF THE TESTICLE

ALEXANDER E. MacDONALD, M.D.
TORONTO, CANADA

Choroidal chorionepithelioma occurred in a young man who complained of a painless mass in the scrotum. Marked endocrine disturbance was present, as he showed some of the secondary manifestations of pregnancy. Following removal of the eye on account of the rapid growth of the tumor, the clinical diagnosis was made; later an autopsy confirmed the findings.

REPORT OF CASE

History.—J. O'G., a married white man, was sent to the Toronto General Hospital on July 4, 1935, by Dr. D. R. Mitchell. The left testicle had been slowly increasing in size for eight months. No pain was noticed until the weight of the tumor caused a dragging sensation in the left groin. For seven weeks previous to his admission hemoptysis was noticed; at first the blood spit up was brownish, then bright red. Frequent bleeding from the nose had been treated for five weeks, without success. Decrease in vision was noticed for one week. He had lost much weight and was lacking in strength and energy. He said that he did not have venereal disease. His wife and two children, aged 2 and 3 years, were well.

Physical Examination.—The left testicle was enlarged to the size of an orange. It was smooth and soft and did not fluctuate, was painless on pressure, did not transmit light and was unattached to the surrounding structures. A small hard and freely movable mass was present in the left groin. The chest showed some impairment of resonance on percussion over the base of the left lung, and breath sounds in this region were diminished. The right breast was prominent, and there was a firm, tender mass beneath the nipple. The left breast was enlarged but not sensitive.

On July 7 examination of the nose showed that the epistaxis came from a small ulcerated area on the right side of the septum. The Aschheim-Zondek test was positive.

On July 8 a roentgenogram of the chest showed secondary tumors in the lung.

Ocular Examination.—The eyes were examined on July 9. The patient complained of pain, and the lids were kept partially closed, as the right eye was sensitive to light. Vision was 5/36 in the right eye and 5/12 in the left eye. A large detachment caused by a mass that was solid in appearance was seen in the upper and outer part of the retina in the right eye. The vessels over this mass were visible with the ophthalmoscope with a + 20.00 lens.

On July 15 2 cc. of procaine hydrochloride was injected into the region of the right ciliary ganglion to relieve pain, followed by the injection of 5 cc. of 70 per cent alcohol.

On July 17 vision in the right eye was reduced to counting of fingers. The eye was very painful, and the tumor had increased greatly in size. The tension was raised to palpation, and enucleation was advised.

On July 18 enucleation of the right eye was performed under local anesthesia.

Treatment.—Several high voltage roentgen treatments of the chest were followed by a reaction so severe that they had to be discontinued. The patient's condition gradually became worse, and he died on July 27, twenty-three days after admission to the hospital.

Laboratory Findings.—The urine was normal. The hemoglobin content was 60 per cent. The Wassermann reaction of the blood was negative.

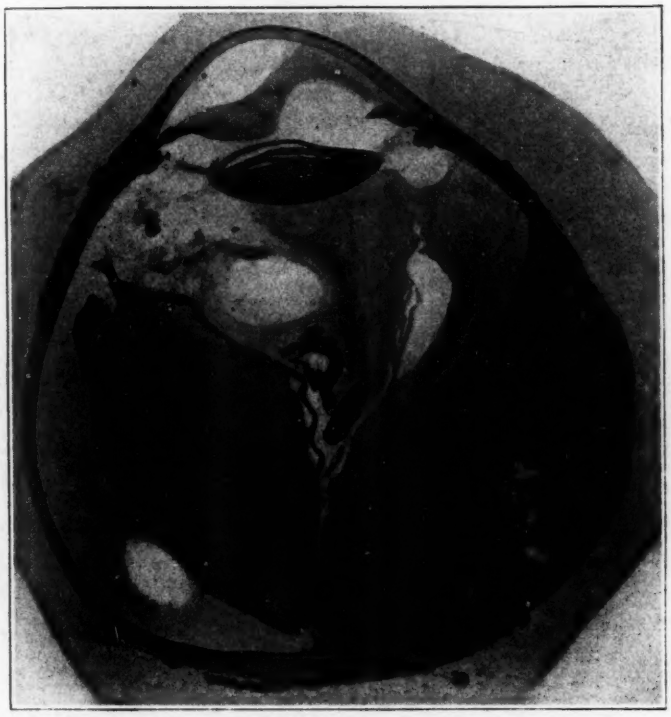

Fig. 1.—Extent of chorionepithelioma of the right eye; magnification, × 3.

Gross Pathologic Examination of the Eye.—The globe (fig. 1) measured 26.7 by 26 by 26 mm.; 5 mm. of optic nerve was attached. When the globe was opened an extensive tumor was found in the upper part; this was embedded in pyroxylin.

Microscopic Examination of the Eye.—The corneal epithelium was intact. The anterior chamber contained exudate which blocked the filtration angles. The lens was intact. The iris and ciliary bodies showed a slight infiltration by mononuclears. In the region of the vitreous a large tumor arising from the choroid occupied about one third of the globe. The retina was completely detached. Hemorrhages were seen in the vitreous, in the subretinal region and extensively

throughout the tumor. The tumor was irregular on staining, many areas having undergone degenerative changes (fig. 2). The tumor cells were of two types: large syncytial cells with multiple large dark-staining nuclei and polyhedral cells with oval vesicular nuclei, which tended to form cords or sheets about the capillary loops and spaces containing blood. The choroidal pigment was scattered in the region of the tumor.

Diagnosis.—The condition was diagnosed as chorionepithelioma of the choroid with multiple intra-ocular hemorrhages.

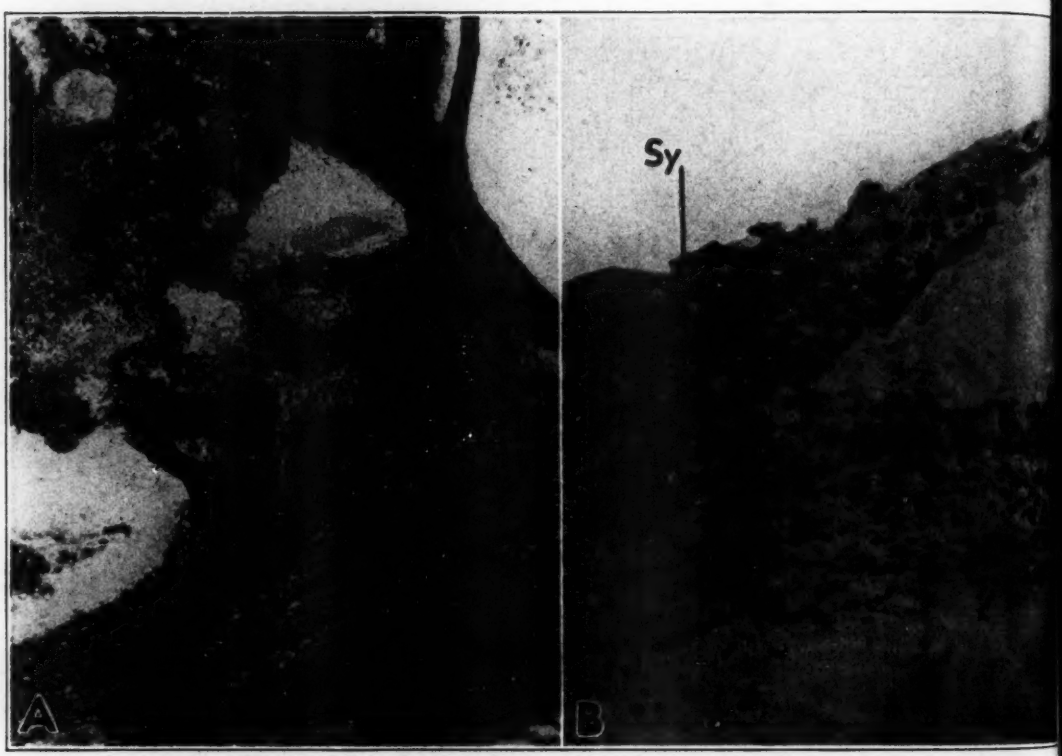

Fig. 2.—*A*, low power photomicrograph of a cross-section of the tumor arising from the choroid, showing areas of hemorrhage and degeneration. *B*, high power photomicrograph of cross-section of the intra-ocular tumor, showing syncytial masses (*Sy*) and Langhans cells surrounding blood-containing spaces.

Synopsis of Report of Autopsy.—The body was emaciated, weighing 97 pounds (44 Kg.). The tumor in the left scrotum was the size of a small orange, moderately firm and slightly lobulated. The cord was thickened. Section of the tumor showed, at the lower pole, a crescentic mass of pale pinkish white homogeneous tissue, moderately firm, with no areas of hemorrhage (seminoma), in contrast to the rest of the tumor (chorionepithelioma), which was soft, varied in color from mottled yellowish brown to dark red and contained many hemorrhagic areas (fig. 3).

Considerable blood oozed from the cut surface, which showed numerous fibrous trabeculae. Similar masses were present in the subcutaneous tissues of the groin and scalp, in the skull, brain, nasopharynx, lungs, pleura, diaphragm, liver, gallbladder, intestines and kidneys and in the retroperitoneal tissue. These masses varied in diameter from a few millimeters to several centimeters. Under each nipple were firm masses measuring from 4 to 5 cm. in diameter and 1 cm. in thickness.

There was a well defined streak of brownish pigmentation of the skin between the umbilicus and the symphysis pubis. Hair was sparse on the face, being limited to the chin and upper lip, and the pubic distribution was female.

Microscopic Examination.—The report on the autopsy material showed that the crescentic area attached to the mass of the testicular tumor was a carcinoma, while the rest of the tumor, like the secondary growths, presented the characteristics of a typical chorionepithelioma. Large necrotic and hemorrhagic areas were

Fig. 3.—Cross-section of the left testicle, showing primary chorionepithelioma with crescentic seminoma (*S*).

present, surrounded by a rim of living tumor tissue. The cells were of two types: polyhedral cells with a vesicular nucleus, which tended to grow in sheets and cords, and syncytial masses of protoplasm having several large dark-staining nuclei. These masses of syncytial cells tended to outline spaces containing red blood cells and showed marked invasive qualities. Sections from the breast showed hypertrophy of the glands, the acini containing a pinkish-staining hyaline secretion. The pituitary gland gave evidence of the profound endocrine disturbance by showing the changes usually present in pregnancy.

COMMENT

This intra-ocular tumor in a man is probably unique. Simidu [1] reported a case in a woman 31 years of age. Malignant glaucoma, pain

1. Simidu, S.: Metastase eines malignen Chorioepithelioms in der Aderhaut, Acta soc. ophth. jap. **39**:2023, 1935.

and blindness necessitated removal of the left eye. The retina was completely detached by a typical chorionepithelioma containing syncytial masses and typical Langhans cells.

In our patient surgical intervention was carried out at a time when treatment in the hospital was considered hopeless and he was about to be removed to his home many miles away. At this time his painful and blind eye was causing severe distress, while the rapid growth of the intra-ocular tumor indicated that rupture of the globe was imminent. Enucleation seemed advisable to relieve pain, although other secondary growths were present. The mixed tumor of the testicle was a true teratoma involving all three primitive layers. All the metastases were of the chorionepithelioma type and were widespread, as shown in the report of the autopsy. These changes were associated with a profound endocrine disturbance, as the patient had some of the secondary manifestations of pregnancy—the linea nigra, accompanied with a female distribution of pubic hair. The breasts were hypertrophied, the acini containing secretion. The pituitary gland showed marked changes, and the Aschheim-Zondek test for urine was positive.

CONCLUSIONS

It is known that distinguishing sexual changes occur late in human development and that remnants of female structure persist in the male. Strange occurrences are often variations of the ordinary that impress by their simplicity.

The case just reported may well be placed in the category of medical curiosities.

A CASE OF HYPERPLASIA OF THE EPITHELIUM OF THE CILIARY PROCESSES

(CILIARY ADENOMA OF E. TREACHER COLLINS)

WILLIAM ZENTMAYER, M.D.

PHILADELPHIA

According to Collins, increased proliferative activity of the epithelial lining of the ciliary body gives rise to small innocent growths at times met with in the eyes of elderly persons. Their presence is discovered only on histologic examination.

In the case here reported and in one other case recorded by Coates such a growth attained sufficient size to lead to the clinical diagnosis of a tumor of the ciliary body. Collins stated: "Springing from the unpigmented layer of cells the growth itself is entirely without pigment, but carries the pigmented layers in front of it as it extends outward. Both layers become invaginated. The lumen of the space so formed communicates with the interior of the eye. If the communication becomes closed and secretions from the lining cells continue a cyst is formed." This occurred in the case reported by Coates.

The lining epithelium of the ciliary body has been described as glandular in character. Tumors arising in it have therefore been termed adenomas. Parsons described them under the term "epithelial hyperplasia or innocent tumors of the ciliary epithelium."

REPORT OF CASE

T. S. G., a woman aged 56 years, the wife of a physician, was sent by Dr. Paul Sartain and was seen by me in consultation. In the early part of 1935 the patient complained of dimness of central vision and of blurred vision in the lower nasal field. This had increased in density and at the time of examination greatly interfered with reading. There was a history of a primary attack of iritis in 1932 and two recurrences. Previous to the patient's visit to me she had had a thorough physical examination, including laboratory tests, and nothing was found bearing on the ocular condition.

Both corneas were a trifle undersized and showed a faint arcus senilis. The right cornea presented a small macula. The anterior chambers were shallow. The tension in each eye was 21. Vision in the right eye was 6/5, with a correcting lens 6/4. Vision in the left eye was 6/27; it was unimproved by glasses but with a pinpoint aperture was 6/7½.

In the right eye the media and fundus were normal. In the left eye the inferior nasal sector of the lens was partially opaque; the fundus was normal.

Read before the American Ophthalmological Society, Hot Springs, Va., June 1, 1936.

With the pupil dilated it was noted that the equator of the lens and zonule were plainly visible below and to the temporal side, as though the lens were partially rotated on its vertical axis by pressure applied on the nasal side.

Biomicroscopic examination showed an area of brownish pigment less than a millimeter in size in the iris at the angle of the anterior chamber and involving the outer circle of the iris. The surrounding iris tissue was slightly elevated. No sequelae of the iritis were present. The lower inner sector of the lens showed some opacity in the layers anterior to the posterior capsule.

Although a tumor was not seen with the ophthalmoscope, the presence of a growth of small size was inferred. A diagnosis of probable sarcoma of the ciliary body was made. Dr. G. E. de Schweinitz and Dr. A. Cowan saw the patient and agreed as to the probability of a tumor's being present. The patient was also seen by Dr. L. C. Peter. Dr. G. E. Pfahler expressed the opinion that as such tumors are usually melanotic they are not amenable to treatment by irradiation.

On July 2, 1935, the eyeball was enucleated. A frozen section of the globe revealed a tumor about 2 mm. in size involving the lower inner portion of the ciliary body. Dr. Eugene Case, the general pathologist of the Graduate Hospital of the University of Pennsylvania, made a diagnosis of adenoma of the ciliary body.

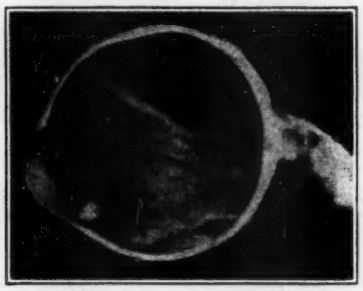

Fig. 1.—Anteroposterior section of the eyeball, showing the tumor.

The specimen was given to Dr. Perce DeLong for a pathologic report. Dr. DeLong agreed with Dr. Case, but as this diagnosis was not concurred in by a third pathologist a single specimen was sent to Dr. F. H. Verhoeff, who submitted the following report:

"The single specimen submitted consists of an anteroposterior section passing near the center of the pupil and through the margin of the optic disk. The section is weakly stained by hematoxylin and eosin. The pupil is 4.25 mm. wide in the section. The eye, except for slight senile changes, shows nothing of importance aside from the tumor. The ocular blood vessels are notably free from sclerosis, although one posterior ciliary artery shows definite proliferation of the intima. The tumor is rounded and measures about 2 by 2.5 mm. It replaces the anterior part of the ciliary body almost to the circulus iridis major and the root of the iris for about 0.75 mm. It is adherent to the posterior surface of the iris to within about 1 mm. of the pupil but is separated from the stroma of the iris by the pigment layer. It is evident from its situation that the tumor arose within an anterior ciliary process, the structure of which it has completely destroyed along with the root of the iris. The tumor is composed of epithelium derived from the pigmented layer of the ciliary epithelium. The epithelium has formed many irregular lumens, some of them of considerable size, lined by a single layer of cells. Protoplasmic

Fig. 2.—Histopathologic appearance of section of the tumor.

Fig. 3.—Section showing the spaces of Fontana in the ligamentum pectinatum solidly filled with pigment epithelium.

processes project from the cells into the lumens and sometimes unite with processes from the opposite side. Outside the lumens the cells have formed tissue closely resembling hyaline connective tissue. Almost everywhere a tendency to form lumens is recognizable, but in small areas the cells have proliferated so irregularly and atypically as to form tissue closely resembling a vacuolated syncytium of neuroglia. No mitotic figures are anywhere seen. The anterior half of the tumor is coated with pigmented epithelium continued from the posterior surface of the iris, but the posterior half is not coated with a definite epithelial layer, although it is well defined. Here zonular fibers are adherent to the surface. In the central part of the tumor cells have formed little pigment, but at the periphery, especially in the region of the filtration angle, the cells are heavily pigmented. Numerous heavily pigmented lumens project from the tumor into the ciliary body, such as often are seen under inflammatory conditions. The spaces of Fontana in the ligamentum pectinatum are solidly filled with pigment epithelium. At the margin of the tumor and the iris the stroma of the latter is slightly infiltrated with lymphocytes. The tumor is pervaded by a small number of blood vessels. The vessels are accompanied by a small amount of connective tissue stroma."

The diagnosis was so-called adenoma, of unusual size, arising in a ciliary process.

COMMENT

In the case reported by Coates, which was recognized clinically, a cyst was found composed of one large and three small loculi, which, however, communicated freely with one another. The largest was situated chiefly within the stroma of the iris tissue, which it split into two layers so that the iris tissue was present both in front of and behind the tumor. Coates predicated a slight inflammation in response to which the unpigmented epithelium began to proliferate. In his case there was evidence of old chorioretinitis. In the case here reported there had been attacks of iritis. In his report Verhoeff stated that there were numerous heavily pigmented lumens projecting from the tumor into the ciliary body such as are often seen under inflammatory conditions.

The case is reported because of the unusual size for this type of tumor and because of the early clinical recognition of the tumor, as only one other case was reported in the literature in which a growth of this type was diagnosed clinically.

Dr. E. Case and Dr. P. DeLong assisted in this study, and Dr. F. H. Verhoeff furnished the report on the microscopic observations.

A TRANSPARENT EXOPHTHALMOMETER

W. H. LUEDDE, M.D.
ST. LOUIS

A variety of appliances have been used or devised for ophthalmostatometry, that is, the measurement of the position of the eyeball within the orbit. According to Morax,[1] the earliest special model was the exophthalmometer of Cohn,[2] shown in 1868 at the Paris meeting of the International Congress of Ophthalmology. Volkman[3] in 1869 and Emmert Keyser[4] and Zehender[5] in 1870 individually proposed modifications of Cohn's instrument. To Zehender belongs the credit for the first use of mirrors in recording the degree of exophthalmos. Snellen[6] presented a further modification, in the textbook of de Wecker and Landolt. A more elaborate instrument was described by Ambriolet[7] in 1893, and perhaps the most complete (as well as the most cumbersome) of all the models was the statometer which Birch-Hirschfeld[8] demonstrated in 1900. Much earlier, Donders had used the ophthalmometer of Helmholtz to determine the position of the apex of either cornea in its relation to a mark preferably made on the bridge of the nose. Antonelli[9] in 1894 demonstrated the possibility of a similar use of Javal's ophthalmometer for this purpose.

From the Department of Ophthalmology, St. Louis University of Medicine.

Read before the Section on Ophthalmology at the Eighty-Seventh Annual Session of the American Medical Association, Kansas City, Mo., May 14, 1936.

1. Morax, V.: Examen du malade et sémiologie oculaire, in Lagrange, F., and Valude, E.: Encyclopédie française d'ophtalmologie, Paris, O. Doin, 1903, vol. 4, pp. 431-441.

2. Cohn: Instrument destiné à déterminer avec précision le degré de saillie du globe oculaire dans l'exophthalmos, Compt. rend. Cong. période. internat. d'opht. **3**:21, 1868.

3. Volkman: Verhandl. k. sachs. Gesellsch. d. Wissensch. **1**:36, 1869.

4. Keyser, Emmert: Ueber die Messungen der Prominenz des Augapfels, Arch. f. Augen- u. Ohrenh. **1**:183, 1870.

5. Zehender: Nochmals ein neuer Exophthalmometer, Klin. Monatsbl. f. Augenh. **8**:42, 1870.

6. Snellen: Art. Ophtalmostatométrie, in de Wecker, L., and Landolt: Traité complet d'ophthalmologie, Paris, A. Delahaye & Cie, 1880.

7. Ambriolet: Mensuration des protrusions oculaires, Ann. d'ocul. **130**:170, 1893.

8. Birch-Hirschfeld, F. V.: Ein neuer Exophthalmometer, Klin. Monatsbl. f. Augenh. **38**:721, 1900.

9. Antonelli: L'ophtalmomètre Javal employé pour l'exophtalmométrie, Arch. d'opht. **14**:529, 1894.

For thirty-five years the instrument most popular for the measurement of the protrusion of the eyeball has been Hertel's [10] *Spiegel* (mirror) exophthalmometer.

Those who desire the maximum of accuracy in these measurements should be referred to Schoenberg's [11] adaptation of the Hertel instrument for use with the binocular corneal microscope. However, none of these instruments is likely to be available for universal practical use by physicians in general practice, internists, surgeons and others who, as well as the ophthalmologist, may be interested in the problems related to exophthalmos.

To secure this greater interest in the actual measurements of protruding eyes so earnestly advocated by Naffziger [12] in his presentation

Fig. 1.—Practical application of the so-called simple Hertel (mirror) exophthalmometer.

Fig. 2.—Application of the truly simple transparent exophthalmometer here presented (face in profile).

of the subject of so-called malignant exophthalmos, attempts were made to secure a device that would be simple, inexpensive, easily applied and reasonably accurate.

The simple exophthalmometer shown in figure 2, which substitutes transparency for mirrored scales, seems to fulfil these purposes.

10. Hertel: Einfacher Exophthalmometer, Arch. f. Ophth. **60**:171, 1905.

11. Schoenberg, Mark J.: A New Model of an Enophthalmometer and Exophthalmometer, Tr. Am. Ophth. Soc. **33**:399, 1935.

12. Naffziger, Howard C.: Address on Malignant Exophthalmos before the St. Louis Medical Society, Jan. 14, 1936.

The base of the transparent ruler is placed directly against the external orbital notch. The ruler must be tilted slightly upward in order to obtain the highest reading for the apex of the cornea. The patient should face good light and look directly forward. When the highest reading at a right angle to the measuring scale is secured this alone is sufficient to insure reasonable accuracy, provided that the ruler is held parallel to the visual axis and that the observer is looking at a right angle through the transparent measuring scale. However, to insure that each subsequent observation is made in the same position it may be well to record a reading without change of position of the lowest part of the bridge of the nose. Thus there will be a relatively permanent measurement by which to check the possible variations in the protrusion of the eyeball. Another simple check may be supplied by a simple straight-edged target finder that can be moved along the measuring scale. A small telescopic magnifier with a meridian marker may be attached to such a right-angled target finder. However, I believe most observers will find that their technic will become so accurate after a few measurements that reliable measurements comparable to previous measurements may be secured, with a possible error not greater than 0.5 mm., which is all that can be hoped for from the Hertel instrument, which has been most regularly used. The use of a transparent measuring scale is the essential novelty in this instrument. Thus far the base, which is made of zylonite, has been attached by Mr. Forest of Erker Bros. Optical Company, St. Louis. It is hoped that the instrument can be molded in one piece to insure uniform accuracy and, ultimately, decreased cost.

Editorial

THE WILLIAM HAMLIN WILDER FOUNDATION

Friends and colleagues of the late Dr. William Hamlin Wilder are establishing a foundation for the purpose of continuing the ideals for which he stood. The foundation is to be based on a fund raised by voluntary contributions and administered by the Northern Trust Company.

The interest of this fund is to be used for the purpose of bringing an outstanding teacher in ophthalmology or an allied topic to Chicago every second year to deliver the "Wilder Lecture." The invitation to the lecturer and the details are to be administered by a governing committee composed of the president and the three most recent past presidents of the Chicago Ophthalmological Society. The lecture is to be printed as a separate brochure and distributed to all contributors to the foundation.

The endeavor is being made to raise the principal sum of $10,000.00. Contributions to this fund are requested, and checks are to be sent to the William Hamlin Wilder Foundation, the Northern Trust Company, LaSalle and Monroe Streets, Chicago.

News and Notes

SOCIETY NEWS

American Board of Ophthalmology.—The American Board of Ophthalmology announces the removal of its executive offices to Room 1002, Beaumont Medical Building, 3720 Washington Boulevard, St. Louis. Dr. John Green is secretary-treasurer.

National Society for the Prevention of Blindness.—Mr. William Fellowes Morgan has been reelected president of the society. Other officers recently elected are: Dr. Park Lewis, of Buffalo, first vice president; Mr. Russell Tyson, of Chicago, second vice president; Mr. Preston S. Millar, of New York, third vice president, and Dr. Edward C. Ellett, of Memphis, Tenn., member of the board of directors, succeeding the late Dr. William H. Wilmer, of Baltimore. The annual conference of the society will be held in Columbus, Ohio, on December 3 to 5.

Heidelberg Congress.—Professor van der Hoeve of Leyden was given the degree of Doctor Honoris Causae by the University of Heidelberg at the recent congress held there. Americans present at the meeting were Dr. Arnold Knapp, of New York; Dr. Joseph Keller, of St. Louis, and Dr. Sanford Gifford, of Chicago.

GENERAL NEWS

Fifteenth International Ophthalmological Congress.—The Fifteenth International Ophthalmological Congress will be held in Cairo, Egypt, on Dec. 8 to 14, 1937. The two official subjects of the congress will be: "Arterial Hypertension of the Retina" and "Endocrinology and the Eye." Papers intended for reading at the scientific meeting should be sent directly to Dr. Marx, Oostzeedijk 316, Rotterdam. All other correspondence should be forwarded to the Secretary General, XV Concilium Ophthalmologicum, P.O.B. No. 2001, Cairo, Egypt.

Retirement of Professor de Grósz.—After more than thirty years' service Professor de Grósz has retired as Director of the First Eye Clinic of Budapest. Professor von Blascovics succeeds him in the position.

Obituaries

EDWARD STURTEVANT STEESE, M.D.
1869-1936

Dr. Edward Sturtevant Steese died of pneumonia on Feb. 8, 1936.

Dr. Steese was born in Massillon, Ohio, in 1869. He graduated in medicine at the Harvard University Medical School, Boston, in 1893 and became connected with the department of neurology of the Vanderbilt Clinic, New York, in 1895 as an assistant to Dr. M. Allen Starr, who then held the chair in that department.

In the fall of 1898 Dr. Steese became associated with Dr. John E. Weeks in the practice of ophthalmology and continued in this practice during the following twenty-five years. During 1899 he became a clinical assistant at the New York Eye and Ear Infirmary, serving for a number of years.

Dr. Steese was a member of the New York County Medical Society, the American Medical Association and the New York Academy of Medicine. He was a gentleman in every respect and was efficient and successful in his professional work. His kindliness and genial bearing gained for him many loyal friends, who will miss him greatly.

JOHN E. WEEKS, M.D.

Abstracts from Current Literature

EDITED BY DR. WILLIAM ZENTMAYER

Anatomy and Embryology

A STUDY OF THE RETICULO-ENDOTHELIAL SYSTEM OF THE EYE BY MEANS OF A MODIFICATION OF VITAL STAINING. I. BORSOTTI, Ann. di ottal. e clin. ocul. 63: 829 (Nov.) 1935.

Borsotti attempted to produce fixation of vital stains in the ocular tissues of rabbits by previously irritating the eyes with chloroform but was not successful. When, however, he placed powdered ethylmorphine hydrochloride in the conjunctival sac and followed this with an injection of lithium carmine or a 25 per cent colloidal solution of thorium dioxide he obtained positive results. He repeated the applications of ethylmorphine hydrochloride every twelve hours, injected the vital stain at intervals of twenty-four hours, and removed the eyes after from twenty-four to ninety-six hours. The eyes treated with ethylmorphine hydrochloride showed a marked increase in the number of cells retaining both the dye and the particles of thorium dioxide. In many cases the control eyes showed no traces of these substances in the cells. The cellular elements showing affinity for these substances were in the conjunctiva, subconjunctival tissues, sclera and cornea. Fixation of these substances was shown only by the tissues which had been exposed most directly to the action of ethylmorphine hydrochloride. Hence fixation was lacking entirely in the iris and deeper structures of the eye. Thorium dioxide was especially localized in cells which could be classed as histiocytes, but some was present also in the endothelial cells and in the fixed connective tissue cells in the sclera and cornea. The presence of reticulo-endothelial elements in the cornea has been denied by some observers. Borsotti recommends this method of vital staining as offering certain advantages over those previously described.

The article includes a bibliography and photomicrographs.

S. R. GIFFORD.

Bacteriology and Serology

THE DISSOCIATIVE INFLUENCE OF THE NORMAL RABBIT CONJUNCTIVA ON BETA HEMOLYTIC STREPTOCOCCI. G. H. GOWEN, Am. J. Ophth. 18: 1140 (Dec.) 1935.

Gowan states the following conclusions:

"1. The characteristics of hemolytic streptococci introduced into the conjunctival sac are definitely altered.

"2. The factor playing the primary part in these alterations is probably the lacrimal secretion, although the conjunctiva itself and other fluids in the conjunctival sac must be considered.

"3. These changes include loss of hemolytic quality, loss of pathogenicity, and varying changes in colony and cell morphology.

"4. This dissociative attenuation of streptococci by the conjunctiva may be considered as one of the defense mechanisms of the eye against bacterial invasion."

W. S. REESE.

ALLERGIC TOXICOSIS FROM ANIMAL PROTEIN AND THE EYE. BIENSTOCK, Schweiz. med. Wchnschr. **66:** 185 (Feb. 15) 1936.

Bienstock reports his own sensitivity to animal protein together with general and ocular disturbances observed over a period of fifty years. Among the signs of generalized reaction are precordial pain, dyspnea, polyuria, nocturia, neuralgic pains, dizziness and albuminuria. His thesis is that such a condition may be the etiologic factor in so-called essential hypertension. The ocular signs were clouding of the vitreous, retinal spasm, entopic phenomena, scotoma, etc. He reports in detail many of his experiences from year to year and shows consistently how abstinence from the animal proteins to which he is sensitive gave him many days of comfort without symptoms. Similar toxicoses in other persons are reported. It is with the hope that the ophthalmologist may be able to help his medical consultant by knowing of such sensitivity that Bienstock reports.

L. L. MAYER

Biochemistry

THE BLOOD-AQUEOUS BARRIER AND VITAMIN C. H. GOLDMANN and W. BUSCHKE, Arch. f. Augenh. **109:** 314, 1935.

In a previous article Goldmann and Buschke showed that the normal blood-aqueous barrier is impermeable to cevitamic acid and that increased permeability of this membrane causes a fall in the amount of cevitamic acid in the aqueous. This explains the high content of vitamin C in the aqueous provided that vitamin C is constantly being formed there. How does vitamin C get into the aqueous? There are two possibilities: 1. The lens synthesizes it from sugar and delivers it to the aqueous. 2. Vitamin C comes from the blood in its reversible oxidized form. Müller and Buschke showed this in aphakic eyes. It is then reduced to cevitamic acid, chiefly by the lens. Both these processes may play a part. The blood reveals only the oxidized form of vitamin C, and this in low concentration, about 2 mg. per hundred cubic centimeters in rabbits. The aqueous under normal conditions shows only the reduced form, in much higher concentration, about 20 mg. per hundred cubic centimeters. There exists a decided discrepancy between the concentration of the reduced form in the aqueous and that of the oxidized form in the blood.

If most of the vitamin is formed from sugar by the lens this portion must be relatively independent of the amount of the vitamin in the blood but closely related to the concentration of sugar in the blood. If cevitamic acid is injected into the blood the amount in the aqueous should increase to the same level. On the other hand, if the cevitamic acid comes originally from the blood the concentration of vitamin C in the blood will be equilibrated with the cevitamic acid in the aqueous. The concentration of the reduced form in the aqueous must depend on the low concentration of the oxidized form in the blood. Every change

of the concentration of vitamin C in the blood must manifest itself in a tenfold concentration in the aqueous. In this case, the amount of vitamin C in the blood regulates the amount of cevitamic acid in the aqueous; in the first case it does not.

In order to test these hypotheses the authors measured the concentration of vitamin C in the blood and the concentration of cevitamic acid in the aqueous of one eye in each of a series of rabbits. A normal amount of cevitamic acid was then injected intravenously. Five minutes after the injection a sample of blood was withdrawn to estimate the high values of the reduced and oxidized forms of vitamin C. In a series of rabbits the aqueous of the second eye was withdrawn at varying periods ranging from five minutes to two days and the vitamin C content compared with that of the opposite aqueous. Then a final sample of blood was examined. They found that after the cevitamic acid was injected intravenously the largest part was immediately transformed into the oxidized form. This sank gradually to the normal value. After half an hour the reduced form in the aqueous had risen considerably, and at this time the reduced form had practically disappeared from the blood. After twenty-one hours the cevitamic acid was still considerably increased in the aqueous, while no more of the reduced form circulated in the blood. In none of the experiments did the concentration of vitamin C in the blood reach the normal concentration of cevitamic acid in the aqueous. These experiments show that the concentration of vitamin C in the aqueous depends on that of vitamin C in the blood.

Further experiments showed that an increase of the oxidized form in the blood produced an increase of the reduced form in the aqueous. Feeding cevitamic acid to a series of rabbits produced no increase in the reduced form of vitamin C but led to a very marked increase in the cevitamic acid of the aqueous.

The authors conclude that excess of the oxidized form of vitamin C in the blood is chiefly responsible for a high concentration of cevitamic acid in the aqueous. Three factors are responsible for the maintenance of the high concentration of cevitamic acid in the aqueous: (1) the regulation of the cevitamic acid through the oxidized form of vitamin C in the blood, (2) the reduction of vitamin C by the lens, and (3) the normal impermeability of the blood-aqueous barrier, which prevents a loss of cevitamic acid from the aqueous into the blood.

F. H. ADLER.

Conjunctiva

ETIOLOGY OF SO-CALLED PARINAUD'S DISEASE: REPORT OF A CASE. A. VON SZILY, Klin. Monatsbl. f. Augenh. **95**: 315 (Sept.) 1935.

Von Szily gives a résumé of what is known of Parinaud's disease and its differential diagnosis, quoting the literature in point. In addition he reports a case. A girl aged 24 presented the disease in the acute stage, with indolent swelling of the right preauricular gland, slight drooping of the right upper eyelid and fleshy excrescences on the conjunctiva tarsi and fornix. The blood was normal except for a slight increase in the number of eosinophils (5 per cent). She showed

no signs of tuberculosis. Material obtained from the patient's conjunctiva and injected subconjunctively into rabbits caused formation of nodules and ulceration in the cornea; this condition did not resemble Parinaud's disease. However, typical rods resembling tubercle bacilli were found in the pus of the ulcerating preauricular gland. They were firm to acid and in von Szily's opinion were identical with bovine tubercle bacilli. Considering the fact that other authors found divers causes for such formations, von Szily concludes that Parinaud's disease, although well defined in appearance, may be caused by divers factors. This view appears to be supported by the observation that inoculation of Bacillus pseudotuberculosis rodentium and Bacterium tularense in animals causes local and general symptoms resembling those of an infection with bovine tubercle bacilli. Von Szily agrees with Schieck that it is doubtful whether fungi alone may cause this disease. Clinical observation is not sufficient to ascertain the diagnosis of Parinaud's disease. It is certain that there are other causative factors, but B. pseudotuberculosis rodentium and Bact. tularense must be considered. It is equally certain that the disease occurs only in persons who have handled animals. Von Szily suggests that the name of the causative factor should be added to the diagnosis of Parinaud's disease, e. g., "Parinaud's disease caused by Bacterium tularense." Subconjunctival and intra-ocular transmission of material from the human conjunctiva and of pus from the glands to rabbits or guinea-pigs is essential for the diagnosis. In this manner a differentiation of the divers groups which are combined under the diagnosis of Parinaud's disease may be possible.

K. L. STOLL.

Comparative Ophthalmology

THE VISUAL PURPLE IN RELATION TO THE VISUAL CELLS OF DIURNAL BIRDS. J. ESCHER-DESRIVIÈRES and M. L. VERRIER, Compt. rend. Soc. de biol. **121**: 383, 1936.

The turtle dove, a typical diurnal bird, has rods and cones in about the same proportion. When this bird was placed in complete darkness for three hours and enucleation then performed in red light no visual purple was evident on inspection of the retina. A similar negative finding was made in the spectrophotometric curve of an extract made with 4 per cent sodium taurocholate. Moreover, the curve did not show the change characteristic of visual purple with ultraviolet rays. The retinas of teleosts and mammals contain visual purple in abundance, though each contains a like proportion of rods. This study indicates that the visual purple is structurally independent of the visual cell.

J. E. LEBENSOHN.

Congenital Anomalies

CONGENITAL OCULAR HYPERPIGMENTATION. G. CAVALACCI, Ann. di ottal. e clin. ocul. **42**: 475 (Dec.) 1935.

Cavalacci observed congenital hyperpigmentation of the eye in three persons. Two were sisters, and the third knew of a paternal cousin

similarly affected. In one patient the condition was unilateral; in the other two patients both eyes were affected. The involved eyes showed patches of pigment in the sclera from the equator forward almost to the limbus. All the subjects were brunettes; their irides were unusually dark, and their fundi were more darkly pigmented than normal. Cavalacci calls attention to the presence of a few pigmented cells in the normal sclera, especially of the brunette, and believes that the condition described is due to hypertrophy and proliferation of these cells, the same process occurring in other parts of the eye. The condition affects chiefly brunettes, and in certain families a hereditary factor seems to be present. In Cavalacci's patients the pupils were relatively refractory to mydriatics.

S. R. GIFFORD.

FAMILIAL CONGENITAL ANOPHTHALMOS. A. TISCORNIA and B. J. TISCORNIA, Arch. de oftal. de Buenos Aires **10**: 355 (June) 1935.

After commenting on the embryology of the eye and on the genesis of anophthalmos and microphthalmos the Tiscornias report bilateral congenital anophthalmos in four members of a single family and in a fifth person not related to the familial group. In two of the first group and in the fifth person affected no trace of an eyeball could be made out by palpation; in the other two of the first group a round hard small body which might be a rudimentary eyeball could be felt on one side. None showed any other developmental abnormalities or stigmas. The first group belonged to a family of nine—four males and five females, two of each sex being affected. No hereditary or other data are available. In the isolated case there was consanguinity between the parents.

C. E. FINLAY.

Cornea and Sclera

BULLOUS KERATITIS: A RATIONAL THERAPY. J. GREEN, Am. J. Ophth. **19**: 16 (Jan.) 1936.

Green refers to the works and conclusions of Allen, Ewing and Bowman on bullous keratitis, enumerates the various changes in the corneal layers and speculates on the origin of the vesicular fluid. He reports two cases in which he removed Bowman's membrane in the bullous area and refers to instances recorded in the literature in which favorable results were probably due to this procedure.

W. S. REESE.

SUBEPITHELIAL KERATITIS PUNCTATA IN A VARNISH WORKER. R. ROSSANO, Bull. Soc. d'opht. de Paris, December 1935, p. 756.

A young man of 25 years had the job of applying varnish on umbrellas. His symptoms were intense photophobia and lacrimation in both eyes. Examination with the slit lamp revealed blebs beneath the surface epithelium of the cornea. The visual acuity of the right eye was reduced to 0.5 and that of the left to 0.9. A culture of material from the conjunctival sacs produced Staphlococcus albus. It was found that

the patient worked in an atmosphere saturated with varnish, as there was no mechanism present for the elimination of the noxious fumes. An analysis of the varnish demonstrated that it consisted of the volatile acetates of amyl, ethyl and butyl acetone, ketone and alcohol. When rabbits' eyes were treated experimentally with these products they showed no reaction. Rossano asks several questions: Is the varnish the etiologic factor in the keratitis? Is the patient especially sensitive to the product? Is it a hemoclastic phenomenon?

L. L. MAYER.

TREATMENT OF ULCUS SERPENS OF THE CORNEA AND OF OCULAR HERPES WITH SHORT WAVE RAYS. W. GRÜTER, Klin. Monatsbl. f. Augenh. **95:** 605 (Nov.) 1935.

Grüter used the short wave rays for from twenty to twenty-five minutes and in some cases subsequent light baths of the head for twenty minutes. [Light baths: thermic treatments frequently applied by inserting the head in an appliance containing a number of electric bulbs, or a semicircular appliance fitted with bulbs, in front of which the patient's head is placed. ABSTRACTOR.] No other local treatment was given except atropinization.

As to the construction of the ocular electrode and the technic of its use, Grüter refers to the monograph of E. Raab entitled "Die Kurzwellen in der Medizin" (ed. 2, Berlin, Radionta-Verlag, 1935). Short wave rays have been used successfully in the treatment of infectious inflammations on the surface of and within the eyeball except tuberculous conditions. The rays successfully attacked pneumococci and the virus of herpes in the cornea. They produced edema of the layers of the cornea and iris, and the net-shaped herpetic infiltration in the parenchyma of the cornea cleared very quickly. Grüter thinks that the action of the rays at a depth, especially in the parenchyma of the cornea, may help prevent recurrences. No burns of ocular tissues were observed as a result of the treatment. He concludes (1) that in the treatment of the conditions named the short wave rays are superior to diathermy and (2) that the biologic action of the rays is due to the intense warmth penetrating into the depth of the tissues, by which the growth of bacteria is stopped, and to the intense increase in the lymph circulating locally. The latter is manifested in a rather protracted edema in the involved corneal tissues; it can be demonstrated also in the acute fibrinous exudate on the normal tissue of the irides of a rabbit the eyes of which have been exposed to intensive treatment with short wave rays.

K. L. STOLL.

TRAUMATIC OCULAR HERPES ZOSTER. E. AMMANN, Klin. Monatsbl. f. Augenh. **95:** 793 (Dec.) 1935.

Ammann discusses the literature on traumatic herpes zoster of the cornea. He refers to the controversy between Grüter and Schönfeld. Grüter succeeded in producing an eruption of typical herpes zoster by injecting brain substance from animals which were infected with herpes.

Schönfeld and other writers, while denying the identity of the original viruses in these experiments of inoculation, admit that these viruses are related. To illustrate the relation between several types of herpes Ammann refers to an observation of his own. A girl of 8 years with typical scars of dendriform keratitis presented herpes simplex of recent occurrence. Eleven years later she presented herpes zoster on both eyelids, the cornea and the forehead, i. e., in the area of the first and second branches of the trigeminus nerve of the same side. Was the age, Ammann asks, instrumental in causing the virus to act in a dermatropic manner at first and neurotropically later?

Sufficient proof has been furnished recently, in Ammann's opinion, for the close relation between herpes zoster and forms of varicella. The virus of herpes simplex is identical, in his mind, with that of herpes zoster. It is known that herpes zoster may develop as a consequence of direct or indirect damage of larger nerves, of the spinal cord or of the spinal ganglions and posterior roots. He quotes briefly the published reports of seven cases and reports an eighth case in support of his view that even slight lesions of the head may be followed by herpes zoster. Some questions will have to be settled: Is the virus a living or an enzymic substance? Is its origin exogenous and does it wander from the wound along the nerves to the gasserian ganglion, or is it endogenous and attracted by the nerves and ganglions through increased neurotic irritation?

The observations prompt Ammann to the opinion that both ophthalmic herpes zoster and simple corneal herpes may be caused by injuries.

K. L. Stoll.

General Diseases

Genealogy of a Family with Juvenile Cataract and of Two Other Families with Retinitis Pigmentosa. J. Arjona, Arch. de oftal. hispano-am. **35**: 551 (Oct.) 1935.

The study of the group with cataract is very complete. This group consists of twenty-six persons with juvenile cataract of the perinuclear type, between the ages of 15 and 30, observed in four generations. There was no sex preference or consanguinity, and the hereditary transmission followed Mendel's dominant type. Arjona inclines toward an unknown disturbance of the hormonal chemistry of the sexual glands as an explanation.

The two groups with retinitis pigmentosa were not so completely studied, owing to the scattering of the different members in different parts of Spain, complete data not being obtainable in all the cases. Each group includes four generations and nine and eight cases, respectively, and in both the dominant type of hereditary transmission is apparent in opposition to the current views, in which the transmission of this disease is considered as belonging to the recessive type. In these groups a greater number of females were attacked, and the defect manifested itself at different stages of life. The author inclines toward a chemical factor in connection with the trophic or hormonal relation between the hypophysis and the retinal pigment as an etiologic explanation.

C. E. Finlay.

TUBERCULOSIS OF THE CHOROID ASSOCIATED WITH GENERALIZED MILIARY TUBERCULOSIS. F. TOOKE, Brit. J. Ophth. **20:** 23 (Jan.) 1936.

A male infant of 13 months suddenly became irritable and was seized with vomiting, fever and a series of convulsions. During one of the attacks the eye and head were turned to the right. Chvostek's sign was present. The anterior cervical glands were enlarged; the posterior ones were small and shotty. The spinal fluid was clear and contained only 2 cells per cubic millimeter. The intradermal tuberculous test was positive. A roentgenogram of the chest showed the lungs peppered or mottled with innumerable tubercles. In the right fundus there were at least seven tubercles, and in the left five, probably more. They were situated between the disk and the macular area and occurred as a cluster or group. They bore no relation to the retinal vessels, which were uninvolved. The surfaces of the disks were a good color and their margins sharply defined. Death occurred twenty-three days after the patient's admission to the hospital.

The postmortem observations and the pathologic anatomy of the eyeballs are given in detail. There was complete absence of any meningeal pathologic process in either the optic nerve or the subdural or vaginal spaces. The author's summary follows:

"Tubercles of the choroid are established as a haematogenous infection in a condition of a generalized miliary tuberculosis.

"Tuberculous meningitis results from contact with necrotic foci from adjacent tissues earlier involved through the blood stream.

"Tuberculous meningitis is a late rather than an early manifestation of the course of the disease.

"Tubercles of the choroid in certain cases are coincident rather than complicating manifestations of tuberculous meningitis.

"Tubercles of the choroid may exist not because of, but in spite of, tuberculous meningitis."

The article is illustrated.

W. ZENTMAYER.

THE EYE AND THE ENDOCRINE GLANDS. P. VANCEA, Arch. f. Ophth. **135:** 1 (Jan.) 1936.

This fairly comprehensive review of the subject of the relations between the eye and the endocrine glands is dedicated to Professor Michail (University of Cluj, Rumania) on the occasion of his fiftieth birthday. The latter's contributions to the subject (the basal metabolic rate of patients with cataract, the influence of insulin on naphthalinic cataract, the effects of extracts of the lacrimal gland, etc.) receive special attention.

P. C. KRONFELD.

Glaucoma

GLAUCOMA ACCOMPANYING NEVUS FLAMMEUS. E. B. DUNPHY, Am. J. Ophth. **18:** 709 (Aug.) 1935.

Dunphy adds two cases of glaucoma associated with nevus flammeus to the sixteen previously reported. He reviews the literature and dis-

cusses the theories advanced. He believes that the glaucoma may be ascribed to obstruction of the filtration angle as a result of angiomatous changes in the uvea or to an increase in the formation of aqueous, which eventually exceeds the capacity of the filtration angle.

W. S. REESE.

SYPHILIS AND PRIMARY GLAUCOMA. W. BECKH, Am. J. Ophth. 18: 1129 (Dec.) 1935.

In a study of the records of the Johns Hopkins Hospital Beckh found no evidence to sustain the view that primary glaucoma is related to syphilis.

W. S. REESE.

SCLERECTOMY WITH IRIDENCLEISIS: A MODIFIED GLAUCOMA OPERATION. W. A. WILLE, Brit. J. Ophth. 20: 229 (April) 1936.

Wille states that the operation is to a certain degree a combination of Herbert's "wedge isolation operation" and iridencleisis. The operation, however, is not done subconjunctivally; the field of operation is exposed by making a conjunctival flap. The two procedures mentioned are combined. A fold of the iris is fastened by suturing with a woman's hair to prevent the iris from returning to the anterior chamber. The bulbar conjunctiva is then drawn over the whole field of operation and fastened on each side of the cornea. The steps of the operation are made clear by a series of line drawings.

W. ZENTMAYER.

IRIDENCLEISIS. D. DIAZ-DOMINGUEZ, Arch. de oftal. de Buenos Aires 10: 375 (June) 1935.

After reference to late infection (in from 2 to 4 per cent) and to subsequent closure of the trephine opening as constituting objections to the Elliot operation, and to iridencleisis as tending to obviate these defects from the time of Bader to the present, Diaz-Dominguez describes his method of operation, which is a modification of that of Weekers and Hubin.

After preliminary administration of phenobarbital, blood letting when the arterial tension is over 170, akinesia, occasional canthotomy and retrobulbar anesthesia, the different steps of the operation are as follows: (1) making of a conjunctival flap after Elliot; (2) scleral incision ab externo after Zirm, 1.5 mm. posterior to the root of the iris; (3) slitting of the iris from the pupillary border to its base; (4) suture of the conjunctival flap.

In thirty-eight operations the only complications which he encountered during operation were perforation of the conjunctival flap and hemorrhage into the anterior chamber with no untoward consequences. The postoperative complications were iritis in two syphilitic patients, anterior luxation of the lens with blocking of the scleral opening, and malignant glaucoma in one patient. Twenty-one operations were for chronic glaucoma, eight for acute, three for secondary and six for absolute glaucoma. In the cases of chronic glaucoma his results were successful in 90.47 per cent and failures in 9.53 per cent; in the cases of

acute glaucoma the corresponding figures were 62.50 and 37.50 per cent; in the six cases of absolute glaucoma, 83.33 and 16.67 per cent. In the three cases of secondary glaucoma successes were observed in 100 per cent.

The cases are described in detail, with remarks and observations of a general character.

C. E. FINLAY.

Hygiene, Sociology, Education and History

PHYSIOLOGIC PROPHYLAXIS OF THE VISUAL ORGAN OF AVIATORS. A. A. BELSKY, Sovet. vestnik oftal. **7**: 511, 1936.

Belsky believes that aviators must have special protective and prophylactic treatment of the visual organ, which is taxed more than in any other profession (requirements: perfect dark adaptation, sudden changes of accommodation, muscular balance, depth adaptation). He advises as a physical prophylactic measure the application of cutaneous stimulants to the cervical vegetative system. The reflective action in this region is followed by acceleration of the circulation of the blood and by improvement of the nutrition of the brain and of the eyes. This method was tried on forty-five subjects who used their eyes intensively, and in 85 per cent accommodative weakness, asthenopia and muscae volitantes disappeared. The initial symptoms of ocular fatigue, diplopia and headaches are relieved by this method.

O. SITCHEVSKA.

Injuries

ATYPICAL, INDIRECT, INCOMPLETE RUPTURE OF THE SCLERA. A. TILLEMA, Brit. J. Ophth. **20**: 193 (April) 1936.

Two types of rupture of the sclera are recognized: typical indirect rupture, most frequently on the inner and upper aspect of the globe, and atypical, in which the rupture may pass not backward but directly outward into the corneal limbus or even forward into the cornea. Tillema describes two cases of a combination of the two types. A typical rupture near the corneal limbus was present in the first case, and an equatorial (atypical) rupture was observed in both cases. A microscopic study was made in both cases, and a detailed description is given, together with photomicrographs. It was mainly the inner layers of the sclera that were affected. Other interesting changes in other parts of the two globes will be described in subsequent papers, one on rupture of the lamina cribrosa and a second on traumatic glaucoma.

W. ZENTMAYER.

CHANGES IN THE ORGAN OF SIGHT DUE TO ULTRASHORT WAVE ROENTGEN RAYS. P. S. PLITAS, Ann. d'ocul. **173**: 110 (Feb.) 1936.

The influence of this new form of radiant energy on human and animal organisms makes one of the most interesting chapters of biology and contemporary medicine. Plitas draws the following conclusions:

1. Ultrashort wave roentgen radiation in strong doses may have a destructive influence on the visual organ.

2. The most marked changes are found in the retina and optic nerve.

3. The changes in the retina are chiefly in the layer of the ganglion cells as disappearance of the cell substance, vacuolation of the protoplasm and shrinkage of the nucleus. In the optic nerve the first degenerative changes take the form of status lacunaris.

4. The physiologic and histopathologic modifications of the eye under the action of the ultrashort wave roentgen rays recall the changes shown by Plitas in cases of general overheating of the organism.

There are eight illustrations and a bibliography.

S. H. McKee.

Modification of the Interior Polar Magnetism in Removing a Deeply Embedded Iron Splinter from the Disk: Subconjunctival, Nonpenetrating Method; Report of a Case. A. Vogt, Klin. Monatsbl. f. Augenh. **96**: 18 (Jan.) 1936.

A sharp-edged small platelet of steel that had been embedded in the optic disk for five days resisted removal with Haab's giant magnet, Mellinger-Klingelfuss' interior polar magnet and other means. Vogt opened the conjunctiva at points about 1 to 2 cm. nasal and temporal to the limbus, introduced his thin interior polar magnet rod alternatingly from the nasal and the temporal side, and advanced it into the neighborhood of the macula. The foreign body was loosened by this magnetic influence from different directions, guided around the lens into the anterior chamber on the following day and extracted through a corneal incision. No scleral incision into the vitreous chamber was required.

K. L. Stoll.

Lacrimal Apparatus

The Lysozyme Content of Tears. W. M. James, Am. J. Ophth. **18**: 1109 (Dec.) 1935.

Using egg white as a source of lysozyme, James investigated tears parallel with dilutions of egg white of known titer. He concludes that lysozyme is a powerful bacteriolytic and bacteriostatic element in tears.

W. S. Reese.

Operation for Chronic Epiphora After Extirpation of the Tear Sac. H. Arruga, Klin. Monatsbl. f. Augenh. **95**: 613 (Nov.) 1935.

Arruga describes a new operation for use in treating the patient with epiphora whose tear sac has been extirpated or who has seen no result from secondary procedures such as electrolysis or extirpation of the tear gland. He illustrates the steps of the operation with twenty pictures. The new method is applicable only if the canaliculi are permeable, especially the lower canaliculus up to its former entrance into the tear sac. The best result is obtained if the lower canaliculus is still 6 mm. long.

The operation resembles dacryocystorhinostomy. It consists in perforating the osseous wall and uniting by sutures the inner termination of the canaliculus with the nasal mucous lining. The instruments required for the operation were described some years ago (Klin. Monatsbl. f. Augenh. **81**: 289, 1928).

Arruga has obtained good results with this operation in ten patients, in one of whom both eyes were operated on. In every one of these patients the tear sac had been extirpated—in one of them over 5 years previously. The result was good in every patient except the one who had the bilateral operation; in her case epiphora persisted for three weeks, until recovery was obtained by probing every four to five days. During the period of postoperative observation epiphora occasionally recurred but disappeared after a few days' treatment.

K. L. STOLL.

Lens

INTRACAPSULAR EXTRACTION OF THE CRYSTALLINE LENS WITH ELECTRODIAPHAKIA: METHOD OF LOPEZ LACARRÈRE. A. MOREU, Am. J. Ophth. **18**: 739 (Aug.) 1935.

Moreu advocates Lacarrère's method of intracapsular extraction by means of the electrodiaphake. This is used to secure coagulation of the capsule of the lens so as to form a solid mass, which adheres to the extracting instrument—a glass terminal from the end of which project several wires. Moreu uses a stronger current, 150 milliamperes, for soft or semisoft cataracts, and 200 or 250 milliamperes for hard cataracts, and has modified the instrument designed by Lacarrère. Twelve cases are reported.

W. S. REESE.

CONGENITAL SUBLUXATION OF THE LENS AND ARACHNODACTYLIA. R. ISNEL and HAKAMI, Bull. Soc. d'opht. de Paris, June 1935, p. 373.

Isnel and Hakami review the cases of this abnormality which have been presented since Marfan demonstrated it in 1896. Their patient, aged 27, had noticed a diminution in vision. The past and familial history were unimportant. The right eye showed superior luxation of the lens, microcornea, iridodonesis, pronounced myopia, chorioretinal lesions but no hypertension of the globe. The left eye showed total luxation of the lens, microcornea, iridodonesis and ocular hypertension of 50 mm. The vision of the right eye was 1/10; that of the left, 1/50. The general appearance was that of arachnodactylia. Measurements are given. Serologic tests gave negative results.

L. L. MAYER.

HISTOLOGIC DEMONSTRATION OF CHOLESTEROL IN VARIOUS TYPES OF HUMAN CATARACTS. E. BUNGE, Arch. f. Augenh. **109**: 503, 1936.

Bunge examined fifty-six lenses extracted by the extracapsular method and eight extracted by the intracapsular method for the presence of cholesterol in the various layers. The methods of preparation are given in full. His conclusions are as follows: Cholesterol can be demonstrated by Schultz' method in 77 per cent of extracapsular extracted

cataracts and in all of the cataracts extracted in their capsules. No cholesterol can be found in clear lenses left in their capsules, but after a capsule has been opened it is possible to detect cholesterol after a time. This histologic picture, however, does not correspond with that found in cataracts. The patient's age is not a factor in the amount of cholesterol present, but the stage of development of the cataract influences the amount considerably, in that the older the lens changes the more cholesterol there is.

F. H. ADLER.

Lids

OPERATIVE TREATMENT OF ENTROPION. S. GALEWSKA and R. LITAUER, Rev. internat. du trachome **13**: 41 (Jan.) 1936.

Among the operations for entropion, the authors consider the procedure recommended by the Australian ophthalmologist Maher the most effective (*Ophthalmoscope* **12**: 206, 1897). The undersurface of the tarsal plate is divided end to end about 3 mm. from its free edge. A flap of mucosa from the lip the length of the incision and 3.5 mm. wide is fixed into this space by a continuous suture. A preliminary canthotomy enhances the effect. No tissue is removed. In the past ten years the authors have observed 221 cases in which this operation was used, and the functional and cosmetic results have been uniformly excellent, even in cases in which the condition had been unsuccessfully treated by other procedures.

J. E. LEBENSOHN.

OPERATION FOR SENILE ECTROPION. J. IMRE, Klin. Monatsbl. f. Augenh. **95**: 303 (Sept.) 1935.

Imre observed that a number of effective operations for senile ectropion correct chiefly the temporal portion of the eyelid, whereas the eversion is usually greater in the nasal portion of the eyelid, especially when it is recent. To overcome this deficiency Imre devised a new method with these steps:

1. An intermarginal incision is made in the central third of the eyelid or wherever the eversion is greatest.

2. A section is made through the skin about 3 mm. from the palpebral margin, parallel to it and for the same distance as the intermarginal incision; on one end of the second incision, usually the temporal end, a vertical incision is made connecting the two incisions. Thus a narrow strip of the palpebral margin is isolated.

3. After the method of Kuhnt a triangle is excised from the combined conjunctiva and tarsus. The base of the triangle measures from 5 to 8 mm.

4. A triangle of corresponding size is excised from the skin below the strip severed from the palpebral margin. The size and shape of this triangle must fit those of the first triangle.

5. The suture of the marginal wound of the conjunctiva and cartilage is laid through the palpebral margin and tied on it. One more suture is laid through the middle of the triangle; the wound in the skin is closed with two sutures. The exuberant portion of the strip on the palpebral margin is cut off, and the vertical edges are carefully united.

This method is useful in the treatment of all types of senile ectropion, including those with thickened conjunctiva which form a transition to ectropion luxurians; it is less fit for those in eyelids the skin of which has been shortened by marginal inflammations or dermatitis.

K. L. STOLL.

Methods of Examination

A NEW ADAPTOMETER. J. NORDMANN and P. PAYEUR, Ann. d'ocul. **173**: 177, 1936.

Examination of the sense of light does not occupy the place in ordinary ophthalmologic practice that it should. This is probably due to the fact that the mechanism used for testing the sense of light is complicated and high-priced. If the practitioner is to be encouraged to examine the sense of light he must be supplied with a simple instrument which is precise and of low price. The adaptometer described here is recommended by Nordmann and Payeur because it fulfils these requirements. They describe the instrument, the manner of its use and the results, and include a tabulation of data on 126 cases. There are also five illustrations. All motorists, aviators and chauffeurs should be examined as to their light sense.

S. H. MCKEE.

QUANTITATIVE DETERMINATION OF CORNEAL AND LENTICULAR OPACITIES. H. M. DEKKING, Arch. f. Ophth. **135**: 90 (Jan.) 1936.

Dekking has devised an instrument for determining the intensity of corneal and lenticular opacities. The object is illuminated by two identical symmetrically arranged illuminating systems. A portion of the light which is diffusely reflected by the opacity enters a receiving optical system located in the symmetrical axes of the illuminating systems. Through the receiving system the observer looks at the eye and compares the intensity of the light received from the opacity with that of a photometer which is built into the instrument. By letting the axes of the illuminators intersect in front of the eye only the corneal opacity is measured.

P. C. KRONFELD.

Neurology

FURTHER OBSERVATIONS ON TUMOR OF THE PINEAL BODY. G. HORRAX, Arch. Neurol. & Psychiat. **35**: 215 (Feb.) 1936.

Horrax reports two cases of tumor of the pineal body. Both patients showed oculomotor signs diagnostic of tumor in this location, namely, loss of pupillary reaction to light and restriction of oculomotor movements above the horizontal. In addition, one showed slight limitation of convergence of the left eye, and the other, slight palsy of the abducens bilaterally. These symptoms were probably the result of the increase in intracranial pressure and were not of the same etiology as the paralysis of upward gaze. Both patients responded well to surgical operation and high voltage roentgen therapy, recovering completely from the oculomotor symptoms. Presumably the oculomotor phenomena were due to

pressure on the corpora quadrigemina. In the discussion it is emphasized that paralysis of the upward gaze is an outstanding symptom of tumor of the pineal body.

R. IRVINE.

TONIC OPHTHALMODYNAMIC REFLEXES. G. BRINCK, Arch. de oftal. hispano-am. **36:** 96 (Feb.) 1936.

The results of experiments on head and body movements as determined reflexly by ocular movements are reported. The experiments were in line with those reported by Aubert-Delaye, Fischer, Kiss and Barré. Brinck's results are more or less confirmatory of those of Kiss and Barré. He utilized principally Barré's otogoniometer, the body deviation being determined in relation to a plumb line and the ocular movement by observation of an object on a wall behind the patient in a mirror that moved on a quadrant.

These experiments tend to show that with the head and body in a normal position lateral movements of the eyes are followed after a few seconds by a corresponding oscillatory deviation, first of the head and then of the body in the same direction; this increases up to a certain point, and if the ocular deviation is prolonged it is apt to terminate in nystagmus. On recovery of the normal position of gaze the normal positions of the head and body are regained or surpassed in a contrary direction. Ocular nystagmus in the opposite direction is observable if the primary deviation has been marked and prolonged. These phenomena are most marked when the head is extended on the occiput. In flexion over 90 degrees the movements of the head and body are reversed. When the gaze is directed up or down, corresponding body and head movements backward or forward are noted. Similar movements are noted if the head is first rotated on its vertical axis. If the arms are extended they show corresponding nystagmoid movements. In some patients these phenomena are accompanied by vertigo.

C. E. FINLAY.

TERROR PSYCHONEUROSIS: AMAUROSIS. M. RENEDO, Arch. de oftal. hispano-am. **36:** 139 (March) 1936.

Renedo reports blindness occurring in both eyes of a soldier after an explosion though the fundi and pupillary reactions were normal. The soldier recovered his sight after successive occlusions of each eye for a number of days.

C. E. FINLAY.

INDICATIONS FOR SURGICAL PROCEDURE IN TUMORS OF THE BRAIN. H. TÖNNIS, Klin. Monatsbl. f. Augenh. **95:** 388 (Sept.) 1935.

Only three types of tumors may be influenced with roentgen therapy: the chromophilic adenoma of the anterior portion of the hypophysis which is associated with acromegaly, the medullary blastoma of the cerebellum occurring in childhood and the glioblastoma in some instances. The treatment of an adenoma of the hypophysis should be given under constant control of the field of vision and of the vision so that reliable surgical intervention will not be delayed if radiation therapy fails. Choked disk may be absent in rare cases even if intracranial pressure is

distinctly increased; to wait for the development of choked disk would increase the operative risk. The vision will be permanently decreased as soon as atrophy begins to follow papilledema. Amaurosis following this condition has changed in Tönnis' experience only twice: in a boy of 14 with astrocytoma of the vermis and in a boy of 5 with teratoma of the epiphysis. Tönnis describes the syndromes of adenoma of the hypophysis, suprasellar cyst of the meatus of the hypophysis and suprasellar meningioma to show the improved possibilities of diagnosing tumors in the area of the chiasm; aside from localizing the tumors, one may recognize their histologic nature in most cases by evaluating the anamnesis, the ocular observations and the roentgenograms. Many patients consult the physician at a late date, especially those with suprasellar tumors, e. g., meningiomas, because the disturbance to which these give rise is comparatively slight. Operation is frequently delayed as a result of extended observations and irradiations. Radical intervention is then often impossible because the tumor has surrounded the carotid artery or its branches. Timely operation might have saved the patient.

K. L. STOLL.

Ocular Muscles

VISION AND ILLUMINATION IN COAL MINES WITH REFERENCE TO MINERS' NYSTAGMUS. F. W. SHARPLEY, Brit. J. Ophth. **20**: 129 (March) 1936.

The paper is devoted to an examination of the evidence available as to what is the minimum illumination necessary to allow the fovea to function normally.

In spite of individual opinions to the contrary, it is now generally agreed by medical authorities that deficient illumination is the chief factor in miners' nystagmus. It is admitted that other contributory causes may exist. The low power of dark adaptation of the fovea prevents the functioning of this part of the retina in the dim lighting which generally obtains in coal mines, and it is believed that it is the long-continued inability to make use of foveal vision that causes nystagmus to develop in miners after years of work underground. (Their average age when the disease becomes so bad that they can no longer work in the mine is about 42 years, and the average number of years spent working underground is about 26 years.) The question whether continued difficulty in fixating vision is the immediate cause is not easy to answer. At illuminations so low that the fovea cannot function properly it is undoubtedly difficult to fixate, but there is evidence that fixation can be accomplished at a brightness considerably below that commonly met with in mining practice. It is, however, significant that in persons with congenital total color blindness, in whom, it is believed, vision is mediated exclusively by the retinal rods and in whom consequently foveal vision is impossible, symptoms of nystagmus are almost invariably present irrespective of the subject's occupation.

It seems safe, then, to assume that to abolish nystagmus sufficient illumination must be provided to allow the fovea to function normally (whether for fixation purposes alone or not). If the various assumptions made are accepted they make clear that to prevent nystagmus the lighting at the coal face must provide a brightness of at least 0.01 candle per square foot.

Taking an objective brightness of 0.01 candle per square foot as the minimum value required to prevent nystagmus Sharpley directs attention to the illumination necessary to produce this brightness on the coal face. He concludes that an ideal cap-lamp should provide a central beam with a total angle of distribution of, say, 60 degrees and an intensity sufficient to illuminate the coal surface (at normal distances) to 0.4 foot-candle and, in addition, an outer concentric beam extending to a total width of 200 degrees horizontally and 120 degrees vertically and of considerably less intensity. Even such a lamp would not allow for extreme peripheral vision with the eyes averted from the "straight-ahead" position, but this loss would probably not have any serious effect on vision or safety. It is interesting to note that the American mining regulations specify a minimum total angle of distribution of 130 degrees for permissible cap-lamps, while Sharpley understands that it is proposed to specify a figure of 100 degrees in the new British regulations.

W. ZENTMAYER.

Operations

RECESSION OPERATION WITH CONTROL SUTURE USING CORRECTION LENSES TO EFFECT MUSCLE BALANCE DURING CONVALESCENCE. O. B. NUGENT, Am. J. Ophth. **18**: 744 (Aug.) 1935.

Nugent describes an operation for recession in which he exposes the muscle and inserts a suture thread which is left loose or tied tightly depending on the effect desired. An advancement, preferably Worth's, may also be done at the same time. Correcting lenses are worn, a patch being used on the operated eye only at night. During the next few days the suture thread may be tightened or loosened to bring about parallelism.

W. S. REESE.

SCLERAL INSERTION OF SPHERES AND SOLID OVOIDS. A. POULARD and E. HARTMANN, Bull. Soc. d'opht. de Paris, June 1935, p. 368.

Poulard and Hartmann review the results of implantation of spheres or ovoids after enucleation of eyes for the period since 1917. The technic has been to disinsert the conjunctiva with a scissors 3 mm. from the corneal limbus. A calotte of the cornea is then removed, which should be elliptic or ovoid with the greatest width 4 mm. The content of the globe is then removed and the globe curetted. Hemorrhage occurring at this time is controlled by a tampon. The perforated ovoid globe is inserted transversally, and the cut edges of cornea are joined by sutures which include the disinserted conjunctiva. The sutures are allowed to remain in place for from eighteen to twenty days. Pain and chemosis occur at times. Complications have occurred only exceptionally, but at times infection has caused the sutures to pull out and the globe to be extruded. Contraindications to this method are intra-ocular tumors, sympathetic ophthalmia or at times endophthalmitis. The chief advantage is the ability to move the prosthesis over such a stump. The operation has been done in 168 cases. In 31 it was done after panophthalmitis; in 19 of these it was successful, and in 12 or 40 per cent, the globe was extruded. The operation was done in 137 cases in which panophthalmitis was not present; in 16, or 10.7 per cent, the globe was extruded; in the remaining 121, or 89.3 per cent, the operation was successful.

L. L. MAYER.

Orbit, Eyeball and Accessory Sinuses

PIGMENTED DEPOSITS ON THE LENS AND CORNEA OF DOUBTFUL NATURE. R. E. WRIGHT and K. K. NAYAR, Brit. J. Ophth. **20**: 295 (May) 1936.

A Hindu boy aged 7 was first seen on Dec. 19, 1924, because of inflammation of the conjunctiva. The condition was of a mixed trachomatous and eczematous nature. There was pannus, more marked above. He had been treated for some time with silver nitrate, copper sulfate, mild protein silver and zinc. In March 1928 the conjunctival and corneal condition was aggravated, and there was a "powdery fluorescent layer just under the lens capsule." In 1929 he was seized with what was probably an attack of malaria. The local treatment included the use of the thermophore and radium. In January 1930 staining of the cornea was definite.

At present there are the remains of a generalized pannus. The corneas present a fairly uniform olivaceous tint. On the anterior capsule are rounded yellowish-brown opacities, 3 mm. in diameter, with chocolate brown somewhat sinuous borders, surrounded by a narrow zone of fine haze. The condition is almost symmetrical in the two eyes.

A striking feature was a shadow of occluded superficial vessels thrown on a gray-green, opaque-looking background apparently coincident with Descemet's membrane. The lens otherwise appeared clear. The pigment deposit seemed to be in the endothelium. With high power the anterior capsular opacity looked like a fine metallic deposit the color of old gold. Surrounding it like a corona were fine radiating whitish lines in the superficial layers of the lens.

Wright and Nayar consider the condition to have been produced either by the metallic compounds used in treatment or by broken-down hemoglobin. They believe there was ample opportunity for local disintegration of hemoglobin.

W. ZENTMAYER.

Physiology

SOME OBSERVATIONS ON THE ACTS OF CLOSING AND OPENING THE EYES. A. J. HALL, Brit. J. Ophth. **20**: 257 (May) 1936.

The article is of considerable length and is difficult to abstract.

Section 1 deals with varieties of eye closure. Three varieties are noted: blinking, closures of rest (bilateral) and winking (unilateral). Blinking is subdivided into that of reflex origin and that of uncertain origin. Blinking of reflex origin is considered under the headings of the corneal reflex, the dazzle reflex and the menace reflex. Blinking of uncertain origin is that which occurs at frequent intervals during waking hours without obvious stimuli of touch, dazzle or menace. The eye closure of rest is discussed as that connected with sleep and that not connected with sleep.

Section 2 deals with the position and movements of the eyes in sleep. The subject is summarized as follows: There is no position which can be called the natural position of the eyes in sleep. Once binocular vision has been acquired the position of the eyes in sleep is usually either horizontal or upward, in about equal proportions. The

eyes are usually symmetrical in that they may be convergent, divergent or both turned to one side. In a small percentage of persons the eyes may be down. Before binocular vision is established the eyes in sleep are to a preponderant extent horizontal and usually symmetrical, though complete askew deviation is not uncommon and may be in any direction. The position of the eyes may or may not differ in the same person in different sleeps. Movements of the eyes may occur in deep sleep. They are usually slow and incoordinate. They appear to be more common in some persons than in others. They may occur at all ages and are not uncommon during the first ten days of life.

Section 3 takes up the behavior of the eyeballs during and after closure of the lids.

Section 4 has to do with the sequence of events in closing and opening the lids. The author's conclusions are: Voluntary closing of the eyes is biphasic. The movement begins in the eyelids, the palpebral phase. When this is completed or nearly completed the eyes begin to change their position, the global phase, and continue to do so until the position of rest has been reached. The act is then complete. In opening the eyes the two phases are reversed; the global phase occurs first, and not until it is completed do the eyelids begin to open (the palpebral phase).

Section 5 relates to closure of one eye (winking). The extent to which persons can close one eye only varies widely. Some persons can close either eye without difficulty and without visible movement of the other lid. Others can wink one eye but not the other. Any attempt to wink the other is accompanied by movement of the opposite lid. Still others cannot wink either eye; every attempt is accompanied by complete or partial closure of the opposite eye.

Section 6 treats of the position of the eyes at rest. In 90 per cent of persons the eyeballs find their position of rest above the horizontal level. They take up a constant position of rest when the eyelids close, and during sleep they may change that position. When the eyes of a sleeping person are examined on successive nights the position of the eyes may vary on each occasion. It seems that there is some direct connection between the acquirement and use of binocular vision and the elevation of the eyes in their position of rest.

The article is illustrated mostly by cinematographic pictures. There is a bibliography.

W. ZENTMAYER.

Refraction and Accommodation

INFLUENCE OF THE THICKNESS OF THE CORNEA AND LENS ON THE TOTAL REFRACTION. M. SMALTINO, Ann. di ottal. e clin. ocul. 64: 109 (Feb.) 1936.

Smaltino's calculations were made on the simplified schematic eye of Gullstrand. He found that a diminution of the corneal thickness by half would cause diminution of only 0.02 diopter in total refraction, so that a change in this factor would never be of appreciable effect. An increase in thickness of the lens of 0.0004 cm. without a corresponding change in the depth of the anterior chamber would reduce the refractive

power of the eye 0.16 diopter, while with the anterior chamber reduced in depth a corresponding amount there would be no change in refraction. Within the limits possible to conceive of in the eye a change of refraction greater than 0.33 diopter could not be attributed to a change in thickness of the lens.

S. R. GIFFORD.

CRITICISM OF OSTWALT'S NEW THEORY OF ANASTIGMATIC LENSES. M. Sundqvist, Arch. f. Ophth. **135:** 67 (Jan.) 1936.

Ostwalt, a French ophthalmologist, was one of the pioneers in the field of the theory of spectacles. His original work (published between 1898 and 1900) served as the foundation for the classic theory of spectacle lenses which was elaborated and completed by Tscherning and von Rohr and led later to the construction of punktal lenses. In July 1934 Ostwalt published a new theory of anastigmatic lenses and declared the classic theory to which he had materially contributed thirty-five years before to be incorrect. The salient point is: What distance from the posterior vertex of the lens should the axes of the astigmatism-free oblique pencils which a meniscus-shaped lens furnishes intersect? Sundqvist defends the classic theory of the punktal lenses as offering the correct solution of the problem.

P. C. KRONFELD.

Retina and Optic Nerve

THE SYMPTOMATIC VALUE OF CHOKED DISK IN SEROUS MENINGITIS. F. TERRIEN, Arch. d'opht. **52:** 465 (July) 1935.

Terrien reports briefly six personal observations of choked disk and has collected fifty-eight others from the literature, some of which are abstracted. He refers briefly to the many different conditions which must be considered, in the differential diagnosis and in determining possible etiologic factors. A survey of these cases, almost all of which have occurred in women, leads to three ocular signs of great importance in the diagnosis of serous meningitis. They are fully discussed under the headings of (1) changes in the fundus of the eye, (2) subjective visual disturbances and (3) oculomotor disturbances. Papilledema, always bilateral, is the outstanding change in the fundus. It differs from the choked disk indicating tumor of the brain in that it appears early, is always present and is less extensive, and lacks the mushroom appearance so characteristic in the case of tumor. Its evolution parallels that of the other symptoms, and its regression takes place with the subsidence of headache. The visual symptoms are constant, constituting with headache, nausea and vomiting the first symptoms of increasing intracranial pressure. They differ from those occurring in the case of tumor in that they appear early. Sometimes they are so severe as to produce complete amaurosis. Attacks of mists and blurring of short duration are especially frequent. The visual disturbances clear after lumbar puncture. Oculomotor symptoms are much less frequent. The sixth nerve is more commonly affected and recovers promptly after treatment.

The prognosis of serous meningitis is good. One must not wait too long even for craniotomy if blindness is to be avoided. Lumbar puncture is often sufficient to effect a cure.

S. B. MARLOW.

LABORATORY STUDIES ON THE OPERATIVE TREATMENT OF DETACHMENT OF THE RETINA. L. WEEKERS, Arch. d'opht. **52**: 636 (Sept.) 1935.

Weekers reviews in some detail the experimental work which he has done on the process of repair after various types of operative treatment of detachment of the retina. He lists the conditions favorable to the production of retinal adhesions: 1. A cicatricial process with participation of both the choroid and episclera is favorable. 2. Participation of the episclera implies perforation not only of the sclera but also of the choroid. 3. The choroidal reaction is very complex, varying in degree with the manner of its production. 4. An extensive diffuse choroidal reaction is harmful and to be avoided. On these grounds the use of caustics and surface coagulation are rejected. 5. The best adhesions result from mild localized choroidal reactions which are grouped in multiple very small foci. 6. Simple puncture produces this ideal result. 7. Diathermic punctures accomplish this but have the disadvantage of allowing the fluid to escape. 8. His experimental work leads him to believe that the choroidal reactions that result from the various types of operation so far employed are excessive. An operation is described which is designed to avoid the objectionable features of those in use and to include the essential features. This consists in first burning through the sclera almost to the choroid by means of a galvanocautery in as many places as desired. Subsequently each hole is punctured with a ground-down thin cataract knife. Care is necessary in the use of the cautery. The variations in the thickness of the sclera in different patients and in different locations in the same eye are emphasized. In his opinion, the variable thickness of the sclera vitiates to some extent the constancy of the reaction to be obtained by L. Coppez' pyrometric electrode. This paper is best read in the original. It contains much valuable fundamental information.

S. B. MARLOW.

THE SCOTOMAS OF PATIENTS WITH RETROBULBAR NEURITIS. L. GENET, Bull. Soc. d'opht. de Paris, November 1935, p. 720.

Genet studied two patients who had evidence of retrobulbar neuritis and were cured by intranasal manipulation and medication. When patients of this type are first seen they show with their diminution of vision a central or paracentral scotoma. Genet is of the belief that scotomas which are due to involvement of the vascular supply and which may be influenced by nasal therapy are not often found at the point of fixation. These scotomas have been shown to be of vascular origin by Genet in demonstrating that they disappear when the nasal mucosa is anesthetized. The central scotoma due to a lesion far back in the optic nerve does not respond to this treatment. He concludes that the majority of scotomas are due not to inflammation of the nerve but most likely to a circulatory condition such as arterial spasms.

L. L. MAYER.

OCCLUSION OF THE CENTRAL ARTERY OF THE RETINA. C. S. DAMEL, Arch. de oftal. de Buenos Aires **10:** 395 (June) 1935.

This paper presents a series of retinographs made in a case of occlusion of the central retinal artery during seven months, commencing forty-eight hours after the loss of vision.

The findings were in every respect typical, and Damel discusses at length the explanations offered by different authors for each type of change, inclining to the following sequence of events: more or less complete occlusion by an embolus, increased by arterial spasm; cessation of the spasm after a certain length of time with consecutive vasodilatation; reestablishment of the circulation; secondary narrowing of the arteries; opacification of the walls of the retinal vessels, and apparent disappearance of peripheric vessels dependent on reduction of the volume of the circulating blood and on peripapillary anastomoses.

In the reported case circulation reappeared as a slow irregular current forty-eight hours after the onset of the accident.

Five months prior to this retinal trouble the patient had an apoplectic seizure with right hemiplegia; the blood pressure was normal; the Wassermann and Kahn reactions were negative; the spinal fluid pressure was 40 (Claude); the second heart sound was increased over the cardiac base and aorta; the reflexes of the right arm and leg were exaggerated.

Damel's diagnosis was embolism of the central artery of the retina.

C. E. FINLAY.

COMPRESSION OF THE OPTIC NERVE BY THE CAROTID ARTERY: REPORT OF A CASE. RIECHERT, Klin. Monatsbl. f. Augenh. **95:** 389 (Sept.) 1935.

Riechert reports a disturbance of the optic nerve by arteriosclerotic changes at the base of the brain. This disorder was of the nature of the optic neuritis or neuroretinitis associated with arteriosclerosis and hypertension which Uhthoff and Beselin described. Transfrontal and intradural exposure of the chiasm after Dandy's method showed that the optic nerve was congested and compressed by the internal carotid artery, which was sclerosed and the walls of which contained platelets of lime. The roentgenogram showed an ampule-shaped distention of the sella turcica. Prior to operation the presence of an aneurysm was excluded by an arteriogram made after Löhr's method. Splitting of the arachnoid combined with subtemporal decompression resulted in creating a wide space between the carotid artery and the optic nerve; this procedure is commendable if done before the visual disturbances have become irreparable. Arteriography after Löhr's method is recommended as being free from risks and just as reliable in ophthalmologic practice as it has been in neurologic surgery. Arteriography has pointed out vascular changes as the etiologic factors and has suggested the rational treatment of aneurysms, unidentified atrophies of the optic nerve in aged persons and other diseases as follows: retrobulbar neuritis, monosymptomatic paresis of the ocular muscles and some types of simple glaucoma. Riechert thinks it will be possible to define characteristic

vascular disturbances in several ophthalmic diseases with further experience along this line and by the use of a special technic.

K. L. STOLL.

THE PROGNOSIS OF THROMBOSIS OF THE CENTRAL RETINAL VEIN. K. WESSELY, Klin. Monatsbl. f. Augenh. **95**: 398 (Sept.) 1935.

Pathologic anatomic observations of Scheerer, Harms and other authors showed that the classic so-called thrombosis of the central retinal vein consists in simultaneous disease of the artery and vein. The final causes of the occlusion of the vein are not definitely known. The course of the disease varies. In some patients it terminates unfavorably; in others the vision may be preserved for a few days, but after a period of weeks amaurosis and frequently secondary glaucoma develop. In other patients the onset may appear very severe, but normal vision may return notwithstanding the presence of complete thrombosis of the trunk of the vein ophthalmoscopically.

Since 1920 Wessely has carefully examined patients whose thrombotic condition followed the latter course. The general condition and blood pressure and the intra-ocular tension of the diseased and of the healthy eye were recorded, especially in the beginning of the disease. He found that the intra-ocular tension in the diseased eye was usually lower than that in the healthy eye when the thrombosis was recent. He referred to this symtom on a previous occasion and his observation has been corroborated by other authors since. He noted that the tension of the diseased eye was also lower, by as much as 12 mm., when there was thrombosis of the branches of the central retinal vein. This decrease is caused, in his opinion, by contraction of the arterial current in the retina and also in some uveal vessels. By far the highest blood pressure, averaging 190 mm., was found in patients with thrombosis of the trunk of the vein terminating with amaurosis or hemorrhagic secondary glaucoma; incidentally, these patients showed the lowest intra-ocular tension. The intra-ocular tension was less decreased and the blood pressure rose to a maximum average of only 160 mm. in those whose vision was preserved to some degree. Full vision returned in three of forty patients with complete regulation of the circulation and absorption of all hemorrhages. These patients were between 39 and 48 years old; their blood pressure was normal, ranging between 120 and 140 mm., and the intra-ocular tension in the diseased eye was barely lower than that in the healthy eye. Nervous vasolability was the only general pathologic symptom noticed. Wessely thinks that the comparatively swift recovery of the circulation, the disappearance of the engorgement and the absorption of the blood were possible for these reasons: The fine capillary net in the lamina cribrosa which connects the ciliary and choroidal veins allowed a collateral outflow by comparatively rapid and complete dilatation; then the arterial flow could soon return, because the blood vessels of these patients were changed to a less degree than those of patients of the other group.

Simultaneous measurements of blood pressure and intra-ocular tension in patients with thrombosis of the central retinal vein may further the understanding of the pathogenesis of this disease and may facilitate prognosis. This research corroborated in many respects the observations of R. Foster Moore.

K. L. STOLL.

Trachoma

RESEARCH ON THE RELATION OF KOCH'S BACILLUS AND THE TUBERCLE VIRUS TO TRACHOMA. J. FRANÇOIS, Arch. d'opht. **52:** 875 (Dec.) 1935.

These experiments were carried out because it had been suggested that trachoma has a tuberculous basis. There are some features of the disease which lend support to this idea. François' previous work on the blood seems to confirm the contention that trachoma develops only in a lymphadenoid terrain. No experimental work has been done which definitely demonstrates that the tubercle bacillus is not present in this disease. In the work reported here trachomatous tissue was inoculated into guinea-pigs without either recovery of the bacillus or demonstration of the presence of its toxins.

S. B. MARLOW.

TRACHOMA AND BACTERIUM GRANULOSIS OF NOGUCHI IN RUSSIA: PRELIMINARY REPORT. E. TRAPEZONTSEVA, Sovet. vestnik oftal. **8:** 231, 1936.

Bacterium granulosis(Noguchi) has not been found frequently in cultures of trachomatous material from persons outside the United States. Trapezontseva believes that the strains isolated in other regions were not identical with those isolated originally by Noguchi. The cause of failing to find the bacterium might, however, have been a variation in the flora of the conjunctiva in various seasons, in the p_H of the secretion, in the character of the trachomatous process (deep or superficial), etc. She succeeded in obtaining Bact. granulosis from the eyes of two persons with chronic, recurrent trachoma who were treated on and off for a year in the hospital. The bacterium was also found in the eyes of 10 per cent of persons with early trachoma in Bashkiry. The strains were identical culturally, serologically and biochemically with those of the Rockefeller Institute for Medical Research.

O. SITCHEVSKA.

Tumors

OCULAR COMPLICATIONS IN NEUROBLASTOMA. P. J. LEINFELDER, Am. J. Ophth. **18:** 938 (Oct.) 1935.

Leinfelder reviews the literature on the syndrome of ecchymosis of the eyelids, exophthalmos, hydrocephalus, secondary anemia, and cachexia, occurring in children with malignant tumors of the adrenal glands. He states the following conclusions:

"1. Neuroblastoma is an occasional cause of proptosis and choked disc in children.

"2. Three cases are presented in which the clinical picture is that of Hutchinson's type of neuroblastoma.

"3. The histopathology of neuroblastoma is not always recognized because of the frequent absence of rosettes and fibrils.

"4. The disease is rapidly fatal despite therapy."

W. S. REESE.

DERMOID CYST WITH CRANIAL MALFORMATION. DE JAEGER, Ann. d'ocul. **173**: 31 (Jan.) 1936.

Joseph J., 14 years of age, was brought to de Jaeger in April 1935 because of a tumor in the left temporal region. He did not present any other malformation. His mother had a tumor of the identical type in the orbital cavity. He was an only child. It was stated that his tumor had always been present, but that it had enlarged since the ninth year. About fifteen days previous to this observation the child had received a blow on the tumor, and the growth seemed to disappear but had reappeared and was the same size as before. Examination showed in the left temporal fossa behind the external wall of the orbit a neoplasm the size of a small pigeon's egg; it was soft and adherent to the bone. Palpation about the tumor gave the impression that some of the bone of that part was deficient. To assure himself that the tumor did not extend intracranially de Jaeger referred the patient to the department of roentgenography. Details of the examination are given, with a photograph.

De Jaeger emphasizes that a chalky bony canal was found in the sphenoid bone. He thinks that this cranial malformation must be rare, as little importance is attached to the subject in the various classic works which he consulted.

S. H. MCKEE.

A BLOOD CYST OF THE ORBIT. D. MICHAÏL, Arch. d'opht. **52**: 851 (Dec.) 1935.

This report is occasioned by the clinical and pathologic observation of a girl 16 years old who ten years before had an eye enucleated because of a severe infection. There was a fluctuating mass in the orbit which produced marked swelling of the lid. At operation a thick-walled cyst was removed, in which a piece of packing was found. A blood cyst of the orbit is extremely rare. The condition is given little consideration in the most recent textbooks. Michaïl has collected a number of cases from the literature; in these the most common cause was traumatic hemorrhage.

S. B. MARLOW.

VASCULAR NEOPLASM OF THE ORBIT. E. TROVATI, Ann. di ottal. e clin. ocul. **64**: 91 (Feb.) 1936.

A man of 29 years had noted a swelling at the inner angle of the upper eyelid six years before. It became larger, the skin assumed a violaceous hue, and the lid drooped. When the eyelid was examined it presented a bluish-red nodule on the under part, extending down on the bulbar conjunctiva. Movement of the globe upward was limited and accompanied by diplopia. Proptosis of 3 mm. was present and was not increased by stooping. Exploratory puncture revealed blood under pressure. The tumor was removed by incision and blunt dissection. It consisted of two kinds of tissue, part being typical of an angioma, while in other parts the vessels were larger, with less supporting structure, and the picture was that of a racemose angioma. It had arisen apparently in the deeper tissues of the eyelid and had extended anteriorly under the bulbar conjunctiva and posteriorly into the orbit.

The second case was that of a girl of 20 years who had noted left exophthalmos for two years. The vision and visual fields were normal, and no diplopia was noted. The left eye was proptosed straight forward 7 mm. By a large incision at the upper inner margin of the orbit an ovoid mass 24 by 18 mm. in size was removed from behind the globe. It was reddish blue and solid. Sections showed a typical cavernous angioma.

A bibliography accompanies the article.

S. R. GIFFORD.

Uvea

THE NERVOUS COMPONENT IN THE CAUSE OF POSTOPERATIVE CYCLITIS. V. N. ARKHANGELSKIY, Sovet. vestnik oftal. **8**: 10, 1936.

Arkhangelskiy reports three cases of postoperative cyclitis in which no morphologic changes (no proliferation of stromal elements) were observed. He attempts to explain them in the light of the new pathologic data. Eight photomicrographs show (1) incomplete coaptation of the edges of operative wound, (2) displacement of the ciliary body toward the incision, (3) adhesion of the iris to the corneal incision, (4) detachment of the ciliary body with tension on some of the ciliary nerves and (5) detachment of the choroid with stretching of the stems of the ciliary nerves in the stretched suprachoroid. In all these changes incarceration and stretching of the ciliary nerves were common; it most likely caused the cyclitis in the eye operated on which was reflected symmetrically in the zone of innervation of the same segment in the second eye—sympathetic irritation. This type of cyclitis is the premorphologic, early phase of the process when there is only mechanical irritation of the ciliary nerves; since the enucleation was done early the morphologic changes did not set in. In some cases, if the therapy is directed toward removal of the focus of infection, it may obviate enucleation. Arkhangelskiy reaches the following conclusions:

1. Neither weak infection or metastasis by way of the blood is an independent etiologic factor, since anatomic changes characteristic of cyclitis are absent in some patients with such findings.

2. Extraction of carious teeth from the point of view of transmission of the infection through the blood (humoral factor) is not the only therapeutic method of curing postoperative cyclitis. Previously carious teeth were not considered as focuses of prolonged weak irritation of the trigeminus nerve. However, the effect of extraction of a diseased tooth on the process demonstrates best the neurohumoral connection between the tooth and the eye.

3. The rôle of the neurohumoral factor in the causation and development of low grade postoperative cyclitis is established in principle.

O. SITCHEVSKA.

Vision

TREATMENT OF THE AMBLYOPIC EYE. W. H. SUMMERSKILL, Brit. M. J. **1**: 1101 (May 30) 1936.

Summerskill has obtained good results by treating amblyopia and draws attention to the disability which unilateral amblyopia gives rise to.

He has grouped his cases under three headings: amblyopia ex anopsia, congenital amblyopia and sequels.

He selected ten patients and by giving them treatment once or twice a week for from six to ten weeks he obtained a clearing up of the strabismus in all except one, and the vision in the amblyopic eye improved in all. He does not mention the method of treatment followed.

He comes to the following conclusions: The virtual blindness of the amblyopic eye is a symptom of a psychologic inhibition; the presence of any causative or secondary anatomic lesion is largely conjectural. The disability which loss of binocular vision involves and the risk of total blindness should the only functioning eye become damaged make a return of vision to even the patient with unilateral amblyopia of the highest importance. There is no justification for regarding the condition as incurable after early childhood and consequently abandoning all effort at treatment. Both in childhood and adult life a useful degree of visual acuity and simultaneous perception can usually be restored, and, with these obtained, any associated squint will disappear.

A. KNAPP.

Visual Tracts and Fields

TRAUMATIC LESIONS OF THE OPTIC CHIASMA. H. M. TRAQUAIR, N. M. DOTT and W. R. RUSSELL, Brain **58:** 398 (Sept.) 1935.

The authors describe two of their own cases of lesions of the optic chiasm with temporal defects in both visual fields following injuries of the head and have collected thirty more from the literature. They have arranged the findings in the form of a table, indicating such main features as the site of injury, the visual acuity, the fields, other cranial complications, etc. They think it surprising that there are not more such cases on record.

Relative to the pathologic observations, they suggest that rarely is the chiasm torn, for it is well protected from fracture except in very severe injuries. It is more probable that injury to the network of blood vessels surrounding the chiasm produces damage to this structure indirectly.

H. L. BEGLE.

Sympathetic Ophthalmia

SYMPATHETIC OPHTHALMIA AND THE NEUROGENIC FACTOR IN THE MECHANISM OF TRANSMISSION OF THE DISEASE FROM THE FIRST TO THE SECOND EYE. V. N. ARKHANGELSKIY, Sovet. vestnik oftal. **7:** 737, 1935.

This thorough and interesting study of the subject cannot be satisfactorily abstracted. The article is divided into the following chapters:

1. Introduction.
   (*a*) The peculiar place sympathetic ophthalmia takes among other pathologic processes of the eye
   (*b*) Sympathetic ophthalmia as an independent nosologic unit
   (*c*) The clinical syndrome of sympathetic ophthalmia

2. The theories of sympathetic ophthalmia, which reflect the state of general pathology: bacterial and abacterial theories (cytotoxins, allergy, anaphylaxis); sympathetic ophthalmia and tuberculosis (Meller).

3. The pathogenesis of sympathetic ophthalmia in the light of analogous symptoms in general pathologic conditions.

(*a*) Personal observations

(*b*) Explanation of this material by neurohumoral factor

Recent physiologic research emphasizes the importance of the nervous system as a universal regulatory system for all physiologic, pathologic and neurodystrophic processes. Irritation of the nerves of the vegetative nervous system changes the function and chemistry of tissues in sections distant from the initial point of irritation. Arkhangelskiy studied slides of eyes enucleated because of sympathetic ophthalmia. The microscopic changes in the ciliary nerves indicated that they were the chief pathogenetic moment of the sympathetic ophthalmia. Perineural and neural infiltration was seen in the sclera along the course of the ciliary nerves. In cases of perineuritis sections stained by the argentophilic method revealed a net of argentophilic fibers in the nerve itself. The lymphoid elements infiltrated the ciliary nerves in some cases so heavily that the fibers could hardly be distinguished. The general etiologic moment for sympathetic opthalmia in all cases, Arkhangelskiy believes, is a prolonged irritation of the nerve endings or of the trunks of the ciliary nervous system. The irritation must be a weak one and of a certain "individual coloring" (Speransky). A perforating injury at the limbus and ciliary muscle destroys the latter. The endings of the ciliary nerves which are intimately connected with the ciliary muscle are irritated by the proteins —the product of disintegration of the cells. In cases of prolonged slow irritation of the ciliary nerves sympathetic ophthalmia usually occurs symmetrically in the other eye, particularly after a certain interval, the period of latency being characteristic of all neurodystrophic processes.

4. Sympathetic irritation and sympathetic inflammation.

5. Effect of enucleation as a liquidation of the chronic irritation of the ciliary nerves and as an additional trauma of the nervous system. The timely enucleation of the first eye as prophylaxis ends the chronic irritation of the endings of the ciliary nerves. The operative trauma not only removes the focus but also creates a new relationship in that segment of the nervous system. Another article will follow on this subject.

Nine photomicrographs illustrate the perineuritis, neuritis and the argentophilic reticular net in the ciliary nerves. O. SITCHEVSKA.

Therapeutics

OSMOTHERAPY FOR DISEASES OF THE EYE. V. P. FILATOV, Sovet. vestnik oftal. **8**: 401, 1936.

Filatov applied osmotherapy in various diseases of the eye. He gave 100 cc. of a 10 or 20 per cent solution of sodium chloride intravenously daily for from ten to fifteen days. The best results were obtained in severe trachomatous pannus, herpetic keratitis and iridocyclitis. In vitreous opacities, neuritis and chorioretinitis the treatment was less effective.

The period of observation and the number of patients treated with hypertonic solutions do not permit him to draw definite conclusions; still he recommends this treatment as an additional therapeutic agent for use when ordinary measures are not sufficient. The action of osmotherapy is explained as follows: The increase in the osmotic pressure of the blood draws the accumulated tissue fluids into the blood vessels; from the blood vessels the excess of fluid goes into the lymphatic vessels. A "lavage" of foci of infection might be produced in this way. The toxic elements coming into the general circulation might stimulate the organism to produce antibodies, ferments, catalyzers, etc. Again, sodium chloride possibly stimulates the secretory activity of the endothelium of the walls of blood vessels and that of the nerve endings, causing a change in the trophicity of the tissues.

O. SITCHEVSKA.

Society Transactions

EDITED BY DR. JOHN HERBERT WAITE

FRENCH OPHTHALMOLOGIC SOCIETY

Forty-Ninth Congress, Paris, May 11-15, 1936

TRANSLATION BY PERCY FRIDENBERG, M.D., NEW YORK

(*Concluded from vol. 16, p. 540*)

PLEA IN JUSTIFICATION OF MEDICAL TREATMENT OF GLAUCOMA. DR. JEAN GALLOIS, Paris.

As long as one admits the legitimacy of treatment with pilocarpine in all cases in which operation does not directly impose itself as a necessity there is no reason to condemn rational attempts at medical treatment of glaucoma if these remain prudent. General examination shows a great number of constitutional changes, organic or functional, in patients with glaucoma, justifying further study and the pursuit of investigations which up to the present have given only imperfect results but which seem to hold out a definite promise of value for the future.

EXTRACTION OF FOREIGN BODIES FROM THE VITREOUS BY THE SCLERAL ROUTE. DR. L. DOR, Lyons.

Comparative statistics on the posterior and the anterior route of extraction of intra-ocular foreign bodies indicate that the results are approximately similar as far as conservation of a satisfactory degree of vision is concerned; viz., 47 per cent for the anterior and 53 per cent for the scleral route. The subsequent retinal detachment which is to be placed on the debit side of the scleral route can be made less frequent by cauterization of the operative incision with pure phenol. Extraction by way of the sclera has the advantages of being less painful, less sudden (*brusque*), and practicable with the small magnet if the latter can carry a weight of at least 4 Kg. (200 Gm. per square millimeter of the surface of a section 20 mm. square). It does, however, require a very exact localization of the foreign body. The technic to which I have remained true for this localization is that which I brought to the notice of the medical profession in 1917 and which has been reviewed at this meeting by Dr. Hartmann in his report.

PICTURES OF THE FUNDUS OCULI (Lantern Slides). DR. SACHS and DR. DIETZ, Vienna, Austria.

No abstract was submitted.

OPHTHALMOSCOPY AT THE LAUSANNE CLINIC. DR. MARC AMSLER, Lausanne, Switzerland.

Indirect ophthalmoscopy (the observation of an inverted image of the interior of the eye) has its own inestimable value as compared with the examination of the upright image, with greater magnification, feasible with the modern electric ophthalmoscopes. As the method of choice for the general and topographic exploration of the fundus, examination with the inverted image is greatly facilitated by the use of the ophthalmoscope which is to be presented and demonstrated. An ingenious yet simple mechanism permits instantaneous maneuvering of the mirrors, i. e., change from the plane mirror—used for examining the transparent media and the light reflex in the pupillary area—to the concave mirror for examining the fundus oculi and vice versa, without changing the line of observation, the position of the ophthalmoscope or the focus of the instrument.

EXPLORATION OF THE FUNDUS OCULI WITH INFRA-RED LIGHT (Lantern Slides). DR. DIAZ-CANEJA, Santander, Spain.

No abstract was submitted.

HISTOLOGIC AND CLINICAL STUDY OF A MYOPIC EYE (Lantern Slides). DR. MAWAS, Paris.

No abstract was submitted.

RETINAL ANGIOSPASMS AND PAROXYSMAL HYPERTENSIVE CRISES. DR. JEAN SÉDAN and DR. GAÖTAN JAYLE, Marseilles.

A patient presented successively crises of vascular spasms of the cortex and extremities and finally, in the course of a fatal attack, bilateral retinal and meningeal spasms. This observation is brought into relation with the two cases of bilateral spasm of the central retinal artery published, one by Bailliart in 1924, the other by Negré in 1929, and both characterized by the simultaneous presence of paroxysmal hypertension. The intensity of the retinal phenomena, the coexistence of multiple vascular spasms which may be expressed in the form of an attack of general vascular hypertension, and finally the extremely grave prognosis as to vision and life characterize this clinical form, which differs radically from all other forms of angiospasm, even those leading to bilateral blindness. It appears to be the ocular expression of generalized intense excitability, a vascular hypersensitivity, of the entire sympathetic nervous system.

ETIOLOGY OF THE RELAPSING OCULAR HEMORRHAGES OF ADOLESCENTS (Lantern Slides). DR. BAILLIART, Paris.

No abstract was submitted.

Fourth Session, May 14

SENILE MACULAR EXUDATIVE RETINITIS. DR. J. FRANÇOIS, Charleroi.

Two cases of an exudative degenerative process at the macula are reported, one of which is specially instructive. In this case the pathologic

process was taken by surprise, as it were, at its very beginning and could be studied from the start. Even before the onset of the first subjective symptom, small spots of capillary dilatation were noted in the region of the macula. The process was followed up for a long time, during which it was possible to note marked variability in the clinical manifestations. There was, later on, a complication in the form of circinate retinitis, indicating that one undoubtedly dealt with two manifestations of one and the same pathologic process. The vascular origin of this condition must be accepted on account of the following signs: numerous hemorrhages, small areas in which the capillaries were dilated, generalized arteriosclerosis, relative hypotension or hypertension of the retinal artery, hypertension or hypotension of the brachial artery, disturbances in the peripheral circulation and a positive ligature sign *(signe du lacet)*. The repeated administration of large doses of acetylcholine gave no evident results but seem nevertheless to have arrested the progress of the disease.

RETINAL TEARS WITHOUT DETACHMENT (Lantern Slides). DR. L. GENET, Lyons.

One of the tears without detachment followed a massive hemorrhage into the vitreous. The hemorrhage had a regular, rounded form with a fairly sharply defined outline and allowed the fundus to be seen, with sclerosis of the choroidal vessels. The other tears were due to large foreign bodies which had penetrated the eye by way of the sclera, causing long narrow tears with, not infrequently, shreds of retinal tissue dividing the tears into several parts, and a retinal fringe floating above the tear. The purpose in this paper is to show that for a retinal detachment to follow a tear the retina must present special histologic lesions. A normal or even slightly damaged retina has a great tendency to solder itself to the deeper lying tissues.

RESULTS OF THE TREATMENT OF RETINAL DETACHMENT WITH DIATHERMIC COAGULATION. OPERATIVE STATISTICS (Lantern Slides). DR. JEANDELIZE, DR. BAUDOT and DR. GAULT, Nancy.

No abstract was submitted.

THE TECHNIC AND RESULTS OF DIATHERMIC OPERATION ON RETINAL DETACHMENT IN 1935 (Lantern Slides). DR. H. WEVE and DR. VAN MANEN, Utrecht, Netherlands.

No abstract was submitted.

RETINAL DETACHMENT: URGENCY OF OPERATION; INJECTION OF AIR; LARGE DISINSERTIONS. DR. H. ARRUGA, Barcelona, Spain.

Complete rest is more urgent than operation. In fact, the first step to be taken, once the diagnosis of detachment has been made, is to insist on and insure complete rest and as far as possible immobilization of the eyes. The operation is sometimes very urgent, but at other times it can be, and not infrequently ought to be, put off for a time. Injection of

air into the vitreous, practiced at the end of the operation, helps to lay the retina against the choroid during the days immediately following the surgical intervention and facilitates that contact of the two membranes which is indispensable for cure. The large disinsertions at the ora serrata are hard to manage, as the free border of the retina never reattaches at the normal point of insertion. The operator should be satisfied if he gets a barrage which is perhaps somewhat farther back than he would like but on a line in which contact between retina and choroid is still possible with rest.

Two Cases of Polymorphic Tumor of the Retina in the Adult. Dr. Dejean, Montpellier, and Dr. Cazalis, Nice.

One patient was a woman aged 62; the other, an underofficer aged 24. Histologic examination showed neoplasms divided into lobes by fibrous partitions made up of neuroglia. These lobes contained polymorphous cells and some giant cells, and the various cellular elements of nerve tissue were present. The entire retina appeared to have spread and become more massive to form the tumor mass. The name "neuroglioblastoma" is suggested for these tumors, and attention is called to the fact that nature is capable of producing not only gliomas but also neoplasms of various nerve cell structure.

Buphthalmos and Unsuspected Intra-Ocular Tumor. Dr. A. Lacroix, Rouen.

A boy of 3 suffered enucleation of an eye on account of buphthalmos with corneal opacity and scleral ectasiae. The posterior pole was intact. A month later an orbital neoplasm appeared, which was made up of small round cells. Soon after, numerous secondary nodules were seen, and death resulted in three months. It appears, then, that the simple diagnosis of buphthalmos is not sufficient and that in every case it is necessary to inquire further into the nature and cause of the condition, bearing in mind that an intra-ocular tumor may take this banal form of infantile glaucoma. On the other hand, enucleation carried out in the glaucomatous stage of an intra-ocular tumor is often, even in the absence of signs of perforation of the globe, too late to offer any safeguard against generalization of the cancer, spread to the orbital tissues and metastases later in other organs.

Horizontal Hemianopia Due to Aneurysm of the Ophthalmic Artery. Dr. T. de Martel, Paris, Dr. J. François, Charleroi, and Dr. J. Guillaume, Paris.

A patient aged 38 had a progressive pseudo-hemianopic contraction of the upper limits of the right visual field with loss of the photomotor reflex in the blind area of the retina. There was a slight increase in pressure of the cerebrospinal fluid which showed dissociation of cytoalbumin and an abnormally high sugar content. In view of the progressive course of this syndrome of compression of the right optic nerve, an exploratory operation was practiced. The nerve was found to

be raised up in the neighborhood of the optic foramen by an aneurysmal dilatation of the ophthalmic artery of at least double the normal size of that vessel.

PAPILLEDEMA AND VENTRICULAR DILATATION (Lantern Slides). DR. T. DE MARTEL and DR. J. GUILLAUME, Paris.

No abstract was submitted.

OPTIC ATROPHY FOLLOWING EXCESSIVE LOSS OF BLOOD (Lantern Slides). DR. PIETTE DUPUYS-DUTEMPS, Paris.

No abstract was submitted.

TWO CASES OF TRAUMATIC ENOPHTHALMOS. DR. CALMETTES and DR. GARIPUY, Toulouse.

The question of the pathogenesis is discussed on the basis of clinical observations. In both cases there had been a violent traumatism which caused a fracture of the lower orbital margin with marked displacement of the globe backward and downward and a striking accentuation of the orbitopalpebral furrow *(sillon)*. The globe itself was uninjured, but its movements were greatly limited in all directions, and there was diplopia which was especially marked in lateral and upward gaze. In explanation of these symptoms one may consider a rupture, or rather a tear of the upper part of the septum orbitale, resulting in a disturbance of the static equilibrium of the globe, which is then drawn backward by the recti. Despite the fact that the fracture was situated in the lower orbital margin we localize the tear in the upper part of the septum on account of the very much slighter resistance to injury of that tissue in this part, and also as a result of our analysis of the nature of the displacement of the globe and the mechanical factors involved. We attribute an entirely secondary and minor rôle, if any, to the incidental slight displacement of bony fragments of the orbital margin and to a hypothetic possible inhibition of the function of unstriped muscle fibers in the orbit.

MONOCULAR FUNCTIONAL PARALYSIS. DR. AUBARET and DR. JAYLE, Marseilles.

Vestibular stimulation enables one to provoke automatic rotation of the eye in every direction of gaze without allowing voluntary movements to play any rôle. We have made use of this experimental method to determine whether there are dissociated disturbances, i. e., involving only one eye, like those which appear in both eyes in the course of binocular functional paralyses. The data gained during research studies which were begun two years ago allow us to answer this question in the affirmative. There are, as a matter of fact, monocular disturbances of motility characterized by a selective involvement, respectively, of voluntary motility and of motility in one or the other direction of gaze provoked by vestibular stimulation. These disturbances amount to functional monocular paralyses, voluntary type or vestibular type. There seem to exist, also, functional monocular paralyses involving both

forms of motility. The pathologic lesion which causes these disturbances is situated at some point between the oculomotor nuclei and the bifurcation of the binocular motor pathways. Monocular nystagmus finds a logical explanation in the data presented.

CURIOUS OCULOMOTOR ANOMALY IN A SQUINTING SUBJECT (Lantern Slides). DR. R. ONFRAY and DR. MARGERIN, Paris.

No abstract was submitted.

DIPLOPIA IN THE COURSE OF EXOPHTHALMIC GOITER. DR. SCHIFF-WERTHEIMER and DR. JUSTIN-BESANÇON, Paris.

No abstract was submitted.

Book Reviews

Bulletin of the Ophthalmological Society of Egypt. Volume 28. Pp. 271, with 37 plates and 1 figure. Cairo: Misr Press, 1936.

This bulletin contains the papers read before the Ophthalmological Society of Egypt on March 22 and 23, 1935, at the Giza Memorial Ophthalmic Laboratory, with Dr. R. P. Wilson presiding. At this meeting Dr. Mahmoud Azmy El-Kattan was elected president of the society for the ensuing year.

In his opening address Dr. Wilson remarked that it was singularly appropriate that the next (fifteenth) International Congress of Ophthalmology was to be held in Cairo, as Egypt is the home of the earliest civilization and learning.

Thirty-six papers on varied subjects were read. Among other topics the following were considered: the ocular complications of endemic diseases (schistosomiasis, ancylostomiasis, ascariasis, leprosy, pellagra, typhoid fever and ocular myiasis), by Dr. El-Tobgy and Dr. Wilson; plastic operations for the restoration of the upper lid, by Dr. El-Tobgy; extraction of cataract by the electrodiaphacic method of Lacarrére, by Dr. M. Khalil (this paper has also appeared in the *British Journal of Ophthalmology* [20: 167, 1936]); the treatment of Bitot's spots with pure phenol and keratitis epithelialis vernalis, both by Dr. El-Tobgy; lipoid infiltrates of the cornea and conjunctiva, and trachomatous interstitial keratitis, both by Dr. Soliman; a case of quinine amblyopia in which the vision and fields returned to normal following the use of an insulin-free pancreatic extract having a vasodilating effect, by Dr. Ekdawi; ocular tuberculosis in Egypt, by Dr. Attiah and Dr. El-Tobgy, and allergy in ocular diseases, by Dr. I. A. Mohamed.

In the section on therapeutic notes Dr. Attiah mentions several important details in tattooing the cornea and reports favorable results in the treatment of argyrosis with sodium thiosulfate and potassium ferricyanide.

The frequency of ocular changes in one hundred and thirty-five cases of diabetes is outlined by Dr. Attiah, and there is a detailed report of the incidence of malignant disease of the eye and its adnexa by Dr. Attiah and Dr. El-Tobgy.

In addition to the papers already mentioned the subjects of which have been given because of their possible interest to American and European ophthalmologists, more than one half of the material in this volume is concerned with diseases of the eyelids, cornea and conjunctiva, owing, of course to the high incidence of trachoma and acute ophthalmia in Egypt.

While many errors in spelling have escaped the proof-readers, one cannot help being impressed both by the wealth of material which is available to ophthalmologists in Egypt and by the conscientious care with which the various cases are worked up.

WALTER F. DUGGAN.

Directory of Ophthalmologic Societies *

INTERNATIONAL

International Association for Prevention of Blindness

President: Prof. F. de Lapersonne, 217 Faubourg St. Honoré, Paris.
Secretary-General: Prof. M. Van Duyse, Université de Gand, Gand, Prov. Ostflandern, Belgium.

International Ophthalmologic Congress

Secretary: Dr. E. Marx, Costzeedijk 316, Rotterdam, Holland.
Place: Cairo. Time: December 1937.

FOREIGN

British Medical Association, Section on Ophthalmology

President: Dr. P. E. H. Adams, 6, Holywell, Oxford.
Secretary: Dr. Thomasina Belt, 13, Mitchell Ave., Jesmond, Newcastle-on-Tyne.
Place: Oxford. Time: July 22-24, 1936.

Ophthalmology Society of Bombay

President: Dr. D. D. Sathaye, 127 Girgaum Road, Bombay 4.
Secretary: Dr. H. D. Dastur, Dadar, Bombay 14.
Place: H. B. A. Free Ophthalmic Hospital, Parel, Bombay 12. Time: First Friday of every month.

Ophthalmological Society of the United Kingdom

President: Mr. Gordon M. Holmes, 9, Wimpole St., London, W. 1.
Secretary: Mr. J. D. M. Cardell, 27, Weymouth St., London, W. 1.

Oxford Ophthalmological Congress

Master: Dr. C. G. Russ Wood, Hill House, Abberbury Rd., Iffley, Oxford, England.
Hon. Secretary-Treasurer: Dr. F. A. Anderson, 12 St. John's Hill, Shrewsbury, England

Royal Society of Medicine, Section of Ophthalmology

President: Dr. Ransom Pickard, 31, East Southernhay, Exeter, England.
Secretary: Dr. A. Rugg-Gunn, 35, Harley St., London, W. 1.

Société Française d'Ophthalmologie

Secretary: Dr. René Onfray, 6 avenue de la Motte Picquet, Paris 7è.

Society of Swedish Ophthalmologists

President: Prof. F. Berg, Uppsala, Sweden.
Secretary: Dr. K. O. Granström, Södermalmstorg 4 III tr., Stockholm, Sö., Sweden.

German Ophthalmological Society

President: Prof. Lohlein, Jena.
Secretary: Prof. A. Wagenmann, Heidelberg.

* Secretaries of societies are requested to furnish the information necessary to make this list complete and to keep it up to date.

Chinese Ophthalmological Society of Peiping

President: Dr. H. T. Pi, Peiping Union Medical College, Peiping.
Secretary: Dr. C. K. Lin, 180 Hsi-Lo-yen, Chienmeng, Peiping.
Place: Peiping Union Medical College, Peiping. Time: Last Friday of each month.

Tsinan Ophthalmological Society

Chairman: Dr. Eugene Chan, Cheeloo University School of Medicine, Tsinan, Shantung.
Place: Cheeloo University School of Medicine. Time: Last Thursday of alternate months.

NATIONAL

American Medical Association, Scientific Assembly, Section on Ophthalmology

Chairman: Dr. William L. Benedict, 102 Second Ave., S. W., Rochester, Minn.
Secretary: Dr. Parker Heath, 1553 Woodward Ave., Detroit.
Place: Atlantic City. Time: June 7-11, 1937.

American Academy of Ophthalmology and Otolaryngology

President: Dr. Frank E. Burch, 408 Peter St., St. Paul.
Executive Secretary-Treasurer: Dr. William P. Wherry, 1500 Medical Arts Bldg., Omaha.

American Ophthalmological Society

President: Dr. Harry Friedenwald, 1212 Eutaw Pl., Baltimore.
Secretary-Treasurer: Dr. J. Milton Griscom, 2213 Walnut St., Philadelphia.

National Society for the Prevention of Blindness

President: Mr. William Fellowes Morgan, 50 W. 50th St., New York.
Managing Director: Mr. Lewis H. Carris, 50 W. 50th St., New York.

SECTIONAL

Central Wisconsin Society of Ophthalmology and Otolaryngology

President: Dr. E. S. Schmidt, 107 E. Walnut St., Green Bay.
Secretary: Dr. G. L. McCormick, 626 S. Central Ave., Marshfield.
Place: Eau Claire. Time: Nov. 6 and 7, 1936.

New England Ophthalmological Society

President: Dr. James J. Regan, 520 Commonwealth Ave., Boston.
Secretary-Treasurer: Dr. William P. Beetham, 5 Bay State Road, Boston.
Place: Massachusetts Eye and Ear Infirmary, 243 Charles St., Boston. Time: 8 p. m., third Tuesday of each month from November to April, inclusive.

Pacific Coast Oto-Ophthalmological Society

President: Dr. A. J. Ridges, Walker Bldg., Salt Lake City, Utah.
Secretary-Treasurer: Dr. Frederick C. Cordes, 384 Post St., San Francisco.
Place: Salt Lake City, Utah. Time: May 24-27, 1937.

Puget Sound Academy of Ophthalmology and Oto-Laryngology

President: Dr. L. H. Klemptner, 509 Olive St., Seattle.
Secretary-Treasurer: Dr. Purman Dorman, Virginia Mason Hospital, Seattle.
Place: Seattle. Time: January 1937.

Rock River Valley Eye, Ear, Nose and Throat Society

President: Dr. A. H. Pember, 500 W. Milwaukee St., Janesville, Wis.
Secretary-Treasurer: Dr. W. H. Elmer, 321 W. State St., Rockford, Ill.
Place: Rockford, Ill., Janesville or Beloit, Wis. Time: Third Tuesday of each month.

SAGINAW VALLEY ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Dr. Robert Griswell, 707 Washington Ave., Bay City, Mich.
Secretary-Treasurer: Dr. W. K. Slack, 308 Eddy Bldg., Saginaw, Mich.
Place: Saginaw, Mich., or Bay City, Mich. Time: Second Tuesday of each month, except July and August.

SIOUX VALLEY EYE AND EAR ACADEMY

President: Dr. L. H. Hohf, Yankton, S. D.
Secretary-Treasurer: Dr. J. C. Decker, Francis Bldg., Sioux City, Iowa.

SOUTHERN MEDICAL ASSOCIATION, SECTION ON EYE, EAR, NOSE AND THROAT

Chairman: Dr. William A. Wagner, 914 American Bank Bldg., New Orleans.
Secretary: Dr. O. M. Marchman, Medical Arts Bldg., Dallas, Texas.

SOUTHWESTERN MICHIGAN TRIOLOGICAL SOCIETY

President: Dr. O. B. McGillicuddy, 1908 Capitol Band Tower, Lansing, Mich.
Secretary-Treasurer: Dr. Maurice C. Loree, 120 W. Hillsdale St., Lansing, Mich.
Time: Third Thursday of alternate months.

WESTERN PENNSYLVANIA EYE, EAR, NOSE AND THROAT SOCIETY

President: Dr. Leslie R. Hazlett, 100 S. Main St., Butler.
Secretary-Treasurer: Dr. C. W. Beals, 41 N. Brady St., DuBois.

STATE

COLORADO OPHTHALMOLOGICAL SOCIETY

President: A presiding officer is selected for each meeting alternately until all members have served.
Secretary: Dr. Edna M. Reynolds, 227, 16th St., Denver.
Place: Capitol Life Building, Denver. Time: 7:30 p. m., third Saturday of the month, October to April, inclusive.

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON EYE, EAR, NOSE AND THROAT

President: Dr. Walter L. Hogan, 750 Main St., Hartford.
Secretary-Treasurer: Dr. Shirley H. Baron, 309 State St., New London.
Time: May, November.

EYE, EAR, NOSE AND THROAT CLUB OF GEORGIA

President: Dr. B. H. Minchew, 701 Elizabeth St., Waycross, Ga.
Secretary-Treasurer: Dr. Edward S. Wright, 1001 Medical Arts Bldg., Atlanta, Ga.

INDIANA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. J. R. Dillinger, French Lick.
Secretary: Dr. Frederick V. Overman, 705 Hume-Mansure Bldg., Indianapolis.

IOWA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. Edwin Cob, 307 Masonic Temple, Marshalltown.
Secretary-Treasurer: Dr. O. L. Thorburn, 213½ Main St., Ames.
Place: Marshalltown. Time: September 1936.

MICHIGAN STATE MEDICAL SOCIETY, SECTION OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

Chairman: Dr. Parker Heath, 1553 Woodward Ave., Detroit.
Secretary: Dr. D. R. Heetderks, 26 Sheldon Ave., S. E., Grand Rapids.

Minnesota Academy of Ophthalmology and Oto-Laryngology

President: Dr. William L. Benedict, Mayo Clinic, Rochester, Minn.
Secretary-Treasurer: Dr. Walter E. Camp, 1918 Medical Arts Bldg., Minneapolis.
Time: Second Friday of each month from October to May.

Montana Academy of Oto-Ophthalmology

President: Dr. Edward S. Murphy, Northern Pacific Hosp., Missoula.
Secretary: Dr. A. W. Morse, 507 Phoenix Bldg., Butte.

New Jersey State Medical Society, Section on Ophthalmology, Otology and Rhinolaryngology

Chairman: Dr. C. Coulter Charlton, 124 S. Illinois Ave., Atlantic City.
Secretary: Dr. H. L. Harley, 124 S. Indiana Ave., Atlantic City.

New York State Medical Society, Eye, Ear, Nose and Throat Section

Chairman: Dr. John F. Fairbain, 925 Delaware Ave., Buffalo.
Secretary: Dr. Walter S. Atkinson, 168 Sterling St., Watertown.

North Carolina Eye, Ear, Nose and Throat Society

President: Dr. Burton W. Fassett, Geer Bldg., Durham.
Secretary-Treasurer: Dr. Casper W. Jennings, 332 N. Elm St., Greensboro.
Place: Durham. Time: Oct. 8, 1936.

North Dakota Academy of Ophthalmology and Oto-Laryngology

President: Dr. Trygve Oftedal, 55½ Broadway, Fargo.
Secretary-Treasurer: Dr. F. L. Wicks, 514 6th St., Valley City.

Oregon Academy of Ophthalmology and Oto-Laryngology

President: Dr. A. B. Dykman, Medical Dental Bldg., Portland.
Secretary-Treasurer: Dr. Andrew J. Browning, 418 Mayer Bldg., Portland.
Place: Good Samaritan Hospital. Time: Third Tuesday of each month.

Rhode Island Ophthalmological and Otological Society

Acting President: Dr. Nathan Bolotow, 108 Waterman St., Providence.
Secretary and Treasurer: Dr. Gordon J. McCurdy, 122 Waterman St., Providence.
Place: Rhode Island Medical Library. Time: 8:30 p. m., second Thursday in October, December, February and April.

South Carolina Society of Ophthalmology and Otolaryngology

President: Dr. R. E. Houston, 103 E. North St., Greenville.
Secretary: Dr. J. W. Jervey Jr., 101 Church St., Greenville.

Tennessee Academy of Ophthalmology and Otolaryngology

President: Dr. W. W. Potter, 601 Walnut St., Knoxville.
Secretary-Treasurer: Dr. W. D. Stinson, 248 Madison Ave., Memphis.

Texas Ophthalmological and Oto-Laryngological Society

President: Dr. T. E. Fuller, 100 W. Board St., Texarkana, Texas.
Secretary: Dr. O. M. Marchman, 1719 Pacific Ave., Dallas.
Place: Fort Worth. Time: Dec. 4 and 5, 1936.

Utah Ophthalmological Society

President: Dr. V. P. White, 143½ S. Main St., Salt Lake City.
Secretary-Treasurer: Dr. E. B. Fairbanks, Boston Bldg., Salt Lake City.
Time: Third Monday of each month.

VIRGINIA SOCIETY OF OTO-LARYNGOLOGY AND OPHTHALMOLOGY

President: Dr. Emory Hill, 501 E. Franklin St., Richmond.
Secretary-Treasurer: Dr. George G. Hankins, Medical Arts Bldg., Newport News.

WEST VIRGINIA STATE MEDICAL ASSOCIATION, EYE, EAR, NOSE AND THROAT SECTION

President: Dr. F. O. Marple, First Huntington National Bank Bldg., Huntington.
Secretary: Dr. J. E. Blaydes, First National Bank, Bluefield.

LOCAL

ACADEMY OF MEDICINE OF NORTHERN NEW JERSEY, SECTION ON EYE, EAR, NOSE AND THROAT

President: Dr. B. E. Failing, 31 Lincoln Park, Newark, N. J.
Secretary: Dr. A. Russell Sherman, 671 Broad St., Newark, N. J.
Place: 91 Lincoln Park South, Newark. Time: 8:45 p. m., second Monday of each month, October to May.

ATLANTA EYE, EAR, NOSE AND THROAT SOCIETY

President: Dr. William O. Martin Jr., 478 Peachtree St., Atlanta, Ga.
Secretary: Dr. A. V. Hallum, 478 Peachtree St., Atlanta, Ga.
Place: Academy of Medicine, 38 Prescott St. Time: Second Friday of each month from October to May.

BALTIMORE MEDICAL SOCIETY, SECTION ON OPHTHALMOLOGY

Chairman: Dr. Jesse W. Downey Jr., 529 N. Charles St., Baltimore.
Secretary: Dr. Mary L. Small, 18 W. Read St., Baltimore.
Place: Medical and Chirurgical Faculty, 1211 Cathedral St. Time: 8:30 p. m., fourth Thursday of each month from October to May.

BROOKLYN OPHTHALMOLOGICAL SOCIETY

President: Dr. Walter V. Moore, 1 Nevins St., Brooklyn.
Secretary-Treasurer: Dr. Mortimer A. Lasky, 1 Nevins St., Brooklyn.
Place: Kings County Medical Society Bldg., 1313 Bedford Ave. Time: Third Thursday in February, April, May, October and December.

BUFFALO OPHTHALMOLOGIC CLUB

President: Dr. Thurber LeWin, 112 Linwood Ave., Buffalo.
Secretary-Treasurer: Dr. Meyer H. Riwchun, 367 Linwood Ave., Buffalo.
Time: Second Thursday of each month.

CHATTANOOGA SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Each member, in alphabetical order.
Secretary: Dr. A. H. Benz, 706 Medical Arts Bldg., Chattanooga.
Place: Mountain City Club. Time: Second Thursday of each month from September to May.

CHICAGO OPHTHALMOLOGICAL SOCIETY

President: Dr. Robert B. Blue, 25 E. Washington St., Chicago.
Secretary-Treasurer: Dr. Thomas D. Allen, 122 S. Michigan Ave., Chicago.
Place: Medinah Michigan Avenue Club, 505 N. Michigan Ave. Time: Third Monday of each month from October to May.

Cincinnati Ophthalmic Club

Chairman: Each member, in rotation.
Secretary-Treasurer: Dr. E. R. Thomas, 819 Carew Tower, Cincinnati.
Place: Holmes Memorial Library, Cincinnati General Hospital. Time: 8:15 p. m., third Monday of each month except June, July and August.

Cleveland Academy of Medicine, Section of Ophthalmology and Otolaryngology

Chairman: Dr. A. D. Ruedemann, 2020 E. 93d St., Cleveland.
Secretary: Dr. Fred W. Dixon, 1029 Rose Bldg., Cleveland.
Place: Winton Hotel. Time: Fourth Friday of each month.

Cleveland Ophthalmological Club

Chairman: Dr. A. B. Bruner, 629 Euclid Ave., Cleveland.
Secretary: Dr. M. W. Jacoby, Hanna Bldg., Cleveland.

College of Physicians, Philadelphia, Section on Ophthalmology

Chairman: Dr. John Milton Griscom, 2213 Walnut St., Philadelphia.
Clerk: Dr. Alexander G. Fewell, 1924 Pine St., Philadelphia.
Time: Third Thursday of every month from October to April, inclusive.

Columbus Ophthalmological and Oto-Laryngological Society

Chairman: Dr. F. W. Thomas, 327 E. State St., Columbus, Ohio.
Secretary-Treasurer: Dr. H. D. Emswiler, 370 E. Town St., Columbus, Ohio.
Place: Athletic Club. Time: First Monday of each month.

Dallas Academy of Ophthalmology and Oto-Laryngology

President: Dr. Hugh L. McLaurin, 1719 Pacific Ave., Dallas, Texas.
Secretary: Dr. Maxwell Thomas, 1719 Pacific Ave., Dallas, Texas.
Place: Dallas Athletic Club. Time: 6:30 p. m., first Tuesday of each month from October to June. The November, January and March meetings are devoted to clinical work.

Des Moines Academy of Ophthalmology and Otolaryngology

President: Dr. E. G. Linn, 604 Locust St., Des Moines, Iowa.
Secretary-Treasurer: Dr. Grace Doane, 614 Bankers Trust Bldg., Des Moines, Iowa.
Time: 7:45 p. m., third Monday of every month, September to May.

Detroit Ophthalmological Club

Chairman: Members rotate alphabetically.
Secretary: Dr. Raymond S. Goux, David Whitney Bldg., Detroit.
Time: 6:30 p. m., first Wednesday of each month.

Eastern New York Eye, Ear, Nose and Throat Association

President: Dr. A. W. Greene, 148 Barrett St., Schenectady.
Secretary-Treasurer: Dr. Joseph L. Holohan, 317 State St., Albany.
Time: Third Wednesday in October, November, March, April, May and June.

Fort Worth Eye, Ear, Nose and Throat Society

President: Dr. T. L. Goodman, 602 W. 10th St., Forth Worth, Texas.
Secretary-Treasurer: Dr. Van D. Rathgeber, 1012 Medical Arts Bldg., Fort Worth.
Place: Medical Hall, Medical Arts Bldg. Time: 7:30 p. m., first Friday of each month except July and August.

Grand Rapids Eye, Ear, Nose and Throat Society

President: Dr. John H. McRae, 26 Sheldon Ave., S. E., Grand Rapids, Mich.
Secretary-Treasurer: Dr. Robert G. Laird, 307 Metz Bldg., Grand Rapids, Mich.
Place: Various local hospitals. Time: Third Thursday of alternating months, September to May.

Houston Academy of Medicine, Eye, Ear, Nose and Throat Section

President: Dr. Henry C. Haden, 1914 Travis St., Houston, Texas.
Secretary: Dr. George C. Farrish, 1625 Main St., Houston, Texas.
Place: Medical Arts Bldg., Harris County Medical Society Rooms. Time: 8 p. m., second Thursday of each month from September to June.

Indianapolis Ophthalmological and Otolaryngological Society

President: Dr. J. C. Daniel, 23 E. Ohio St., Indianapolis.
Secretary: Dr. Kenneth L. Craft, 23 E. Ohio St., Indianapolis.
Place: University Club. Time: 6:30 p. m., second Thursday of each month from October to May.

Kansas City Society of Ophthalmology and Oto-Laryngology

President: Dr. H. B. Davis, 1101 Grand Ave., Kansas City, Mo.
Secretary: Dr. Byron Black, Professional Bldg., Kansas City, Mo.
Time: Third Thursday of each month from September to May. The November, January and March meetings are devoted to clinical work.

Long Beach Eye, Ear, Nose and Throat Society

Chairman: Dr. K. C. Brandenburg, 110 Pine Ave., Long Beach, Calif.
Secretary-Treasurer: Dr. Ben K. Parks, 619 Professional Bldg., Long Beach, Calif.
Place: Professional Bldg. Time: Last Wednesday of each month from October to May.

Los Angeles Society of Ophthalmology and Oto-Laryngology

President: Dr. William A. Boyce, 727 W. 7th St., Los Angeles.
Secretary-Treasurer: Dr. John P. Lordan, 2007 Wilshire Blvd., Los Angeles.
Place: Los Angeles County Medical Association Bldg., 1925 Wilshire Blvd. Time: 6:30 p. m., fourth Monday of each month from September to May, inclusive.

Louisville Eye, Ear, Nose and Throat Society

President: Dr. J. S. Bumgardner, Heyburn Bldg., Louisville, Ky.
Secretary-Treasurer: Dr. Max Bornstein, Heyburn Bldg., Louisville, Ky.
Place: Brown Hotel. Time: 6:30 p. m., second Thursday of each month from September to May, inclusive.

Medical Society of the District of Columbia, Section of Ophthalmology and Otolaryngology

Chairman: Dr. Arthur M. Zinkham, 815 Connecticut Ave., Washington.
Secretary: Dr. E. J. Cummings, 1835 I St., N. W., Washington.
Place: 1718 M St., N. W. Time: 8 p. m., third Friday of each month from October to April, inclusive.

Memphis Society of Ophthalmology and Otolaryngology

Chairman: Each member, in alphabetical order.
Secretary: Dr. R. O. Rychener, 130 Madison Ave., Memphis, Tenn.
Place: Eye Clinic of Memphis Eye, Ear, Nose and Throat Hospital. Time: 8 p. m., second Tuesday of each month.

Milwaukee Oto-Ophthalmic Society

President: Dr. Hilmar G. Martin, 231 W. Wisconsin Ave., Milwaukee.
Secretary-Treasurer. Dr. Herbert G. Schmidt, 238 W. Wisconsin Ave., Milwaukee.
Place: University Club. Time: 6 p. m., second Tuesday of each month.

Minneapolis Ophthalmological Society

Chairman: Each member in alphabetical order.
Secretary: Dr. C. W. Rucker, 527 Medical Arts Bldg., Minneapolis.
Place: Hennepin County Medical Society rooms. Time: 6:30 p. m., fourth Monday of each month, October to May, inclusive.

Montgomery County Medical Society

Chairman: Dr. W. J. Blackburn, 663 Reibold Bldg., Dayton, O.
Secretary-Treasurer: Dr. F. J. Driscoll, 986 Reibold Bldg., Dayton, O.
Place: Van Cleve Hotel. Time: 6:30 p. m., bimonthly, first Tuesday from October to June, inclusive.

Montreal Ophthalmological Society

President: Dr. Stuart Ramsay, 1496 Mountain St., Montreal, Canada.
Secretary: Dr. J. Rosenbaum, 1396 St. Catherine St., West, Montreal, Canada.
Time: Second Thursday of October, December, February and April.

Nashville Academy of Ophthalmology and Otolaryngology

Chairman: Dr. Kate S. Zerfoss, 119, 7th Ave., N., Nashville, Tenn.
Secretary-Treasurer: Dr. Fowler Hollabaugh, Doctors Bldg., Nashville, Tenn.
Place: St. Thomas Hospital. Time: 8 p. m., third Monday of each month from October to June.

New Orleans Ophthalmological and Otolaryngological Society

President: Dr. R. H. Fisher, Chess and Checker Club, New Orleans.
Secretary-Treasurer: Dr. H. F. Brewster, 837 Gravier St., New Orleans.
Place: Eye, Ear, Nose and Throat Hospital. Time: Third Thursday of each month from October to June.

New York Academy of Medicine, Section of Ophthalmology

Chairman: Dr. John H. Dunnington, 30 W. 59th St., New York.
Secretary: Dr. LaGrand H. Hardy, 30 E. 40th St., New York.
Time: 8:30 p. m., third Monday of every month from October to May, inclusive.

Omaha and Council Bluffs Ophthalmological and Oto-Laryngological Society

President: Dr. W. H. Stokes, 107 S. 17th St., Omaha.
Secretary-Treasurer: Dr. Delbert K. Judd, 1020 Medical Arts Bldg., Omaha.
Place: Omaha Club, 20th and Douglas Sts., Omaha. Time: 6 p. m., dinner; 7 p. m., program; third Wednesday of each month from October to May.

Passaic-Bergen Ophthalmological Club

President: Dr. E. C. Reynolds, 657 Main Ave., Passaic, N. J.
Secretary-Treasurer: Dr. T. A. Sanfacon, 80 Park Ave., Paterson, N. J.
Place: Paterson Eye and Ear Infirmary. Time: 9 p. m., last Friday of every month, except June, July and August.

Philadelphia County Medical Society, Eye Section

Chairman: Dr. Sidney L. Olsho, 235 S. 15th St., Philadelphia.
Secretary: Dr. Edmund B. Spaeth, 1930 Chestnut St., Philadelphia.
Time: First Thursday of each month from October to May.

Pittsburgh Ophthalmological Society

President: Dr. Glendon E. Curry, Westinghouse Bldg., Pittsburgh.
Secretary: Dr. George H. Shuman, Park Bldg., Pittsburgh.
Place: Pittsburgh Academy of Medicine Bldg. Time: Fourth Monday of each month, except June, July, August and September.

Pittsburgh Slit Lamp Society

President: Dr. W. W. Blair, 121 University Pl., Pittsburgh.
Secretary: Dr. George H. Shuman, Park Bldg., Pittsburgh.
Place: Falk Clinic. Time: 4 p. m., second Friday of every month, except June, July, August and September.

Richmond Ophthalmological and Oto-Laryngological Society

President: Dr. Robert H. Courtney, Professional Bldg., Richmond, Va.
Secretary: Dr. Richard W. Vaughan, Medical Arts Bldg., Richmond, Va.
Place: Westmoreland Club. Time: 6 p. m., second Monday of each month from October to May.

Rochester Eye, Ear, Nose and Throat Society

President: Dr. R. E. Elliott, 78 S. Fitzhugh St., Rochester, N. Y.
Secretary-Treasurer: Dr. Raphael Farber, 280 Monroe Ave., Rochester, N. Y.
Place: Rochester Medical Association, 113 Prince St. Time: 8 p. m., third Monday of each month from October to May.

St. Louis Ophthalmic Society

President: Dr. Carl T. Eber, 308 N. 6th St., St. Louis.
Secretary: Dr. W. M. James, 508 N. Grand Ave., St. Louis.
Place: Oscar Johnson Institute. Time: Clinical meeting 5:30 p. m., dinner and scientific meeting 6:30 p. m., fourth Friday of each month from October to April, inclusive, except December.

San Antonio Ophthalmolo-Oto-Laryngological Society

President: Dr. Oscar H. Judkins, 414 Navarro St., San Antonio, Texas.
Secretary-Treasurer: Dr. Wilfred E. Muldoon, 414 Navarro St., San Antonio, Texas.
Place: Bexar County Medical Library. Time: 8 p. m., first Tuesday of each month from October to May.

San Francisco County Medical Society, Section on Eye, Ear, Nose and Throat

Chairman: Dr. Lewis F. Morrison, 490 Post St., San Francisco.
Secretary: Dr. Joseph W. Crawford, 490 Post St., San Francisco.
Place: Society's Building, 2180 Washington St., San Francisco.
Time: Fourth Tuesday of every month except May, June, July and December.

Shreveport Eye, Ear, Nose and Throat Society

President: Dr. John T. Crebbin, 624 Travis St., Shreveport, La.
Secretary-Treasurer: Dr. J. A. Wilkinson, Medical Arts Bldg., Shreveport, La.
Place: 1240 Texas Ave. Time: 7:30 p. m., first Monday of every month except July, August and September.

Spokane Academy of Ophthalmology and Oto-Laryngology

President: Dr. C. A. Veasey Jr., 407 Riverside Ave., Spokane, Wash.
Secretary: Dr. Philip B. Greene, Old National Bank Bldg., Spokane, Wash.
Place: Paulsen Medical and Dental Library. Time: 8 p. m., fourth Tuesday of each month except June, July and August.

Syracuse Eye, Ear, Nose and Throat Society

President: Dr. W. J. Werfelman Jr., 725 State Tower Bldg., Syracuse, N. Y.
Secretary-Treasurer: Dr. I. Herbert Katz, 212 Medical Arts Bldg., Syracuse, N. Y.
Place: University Club. Time: First Tuesday of each month except June, July and August.

Toronto Academy of Medicine, Section of Ophthalmology

Chairman: Dr. Samuel Mortimer Lyon, 122 Bloor St., W., Toronto.
Secretary: Dr. A. Lloyd Morgan, 86 Bloor St., West, Toronto.
Time: First Monday, November to April.

Washington, D. C., Ophthalmological Society

President: Dr. James M. Greear Jr., 1740 M St., N. W., Washington, D. C.
Secretary-Treasurer: Dr. Ernest Sheppard, 927 17th St., Washington, D. C.
Place: Episcopal Eye, Ear and Throat Hospital. Time: 8 p. m., first Monday in November, January, March and May.